THE DAVIS GAS-STOVE CO., LTD.,

Specialities in "ARTISAN" Gas Cooking-Stoves.

The "S.M." CAST-IRON COOKER,

Specially designed, and strongly constructed for Gas Companies using the Automatic Meter.

This Stove has an Oven large enough to take a 10-lb. Joint, and is fitted with Dripping-Pan, two Grids, and one Sheet-Iron Shelf, Cross-Bar, and Meat-Hook. The Hot-Plate is fitted with two Boiling-Burners, Heat-Deflector, Pan and Grid, and will also Grill Chops, Steaks, Toast Bread, &c. At a practical test made by a Gas Company, 4 lbs. of Meat and two Vegetables (3 lbs. of Potatoes and a good sized Cabbage) were thoroughly cooked at the cost of 1¼d.; the Gas being passed both through a Test and an Automatic Meter. Such a meal may be easily prepared and served in an hour-and-a-half, burning only 26 cubic feet of Gas in an hour-and-a-quarter—an economic consumption probably never obtained before. This marvellous little Cooker roasts, bakes, boils, &c., to perfection.

DIMENSIONS.

HOT-PLATE: 14¾ in. wide, 15½ in. deep.

DOOR OPENING: 18 in. high, 11½ in. wide.

INSIDE ROASTER: 21 in. high, 11½ in. wide, 11½ in. deep.

PRICES: With Deflector, Pan, and Grid, **£1 17s. 6d.**; without, **£1 15s.**

The Oven is fitted with two Burners, so arranged that they can be readily taken out for cleaning, and replaced without disconnecting the Stove.

The "CAM" CAST-IRON COOKER.

We can strongly recommend this Stove to the notice of intending purchasers, as it contains all our latest improvements in Single-Cased Stoves; and, considering the points of strength and general finish, it is decidedly a cheap Kitchener for the money.

It is fitted with three Ring-Burners and Grilling-Burner, and Deflector, Pan, and Grid. The top plate beneath Hot-Plate is **enamelled white.**

REQUIRED SPACE: 27½ in. high, 18 in. wide, 16½ in. deep.

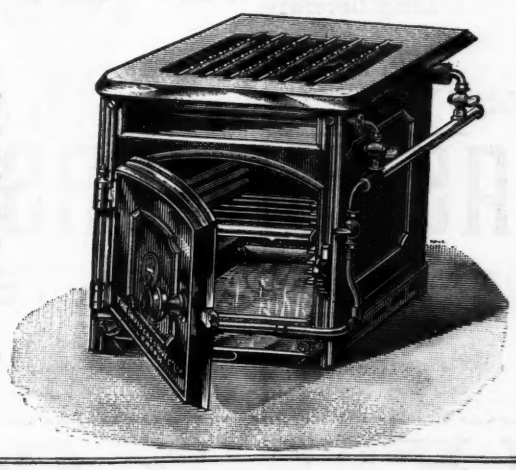
INSIDE DIMENSIONS OF ROASTER: 21 in. high, 11½ in. wide, 11½ in. deep.

Price - - - - - £3

The "BRADFORD."

This Stove has been specially designed for use on the top of ordinary Kitchen Ranges, where room cannot be spared to fix it separately. It is made entirely of Cast Iron, with two Wrought Burners, one 4 in. by ½ in., the other 4 in. by ⅜ in., and has Grid, Bar, Meat-Hook, and Dripping-Pan.

The Oven is fitted with our Patent Regulating Jet.



REQUIRED SPACE.

High.	Wide.	Deep.
18½ in.	17½ in.	20 in.

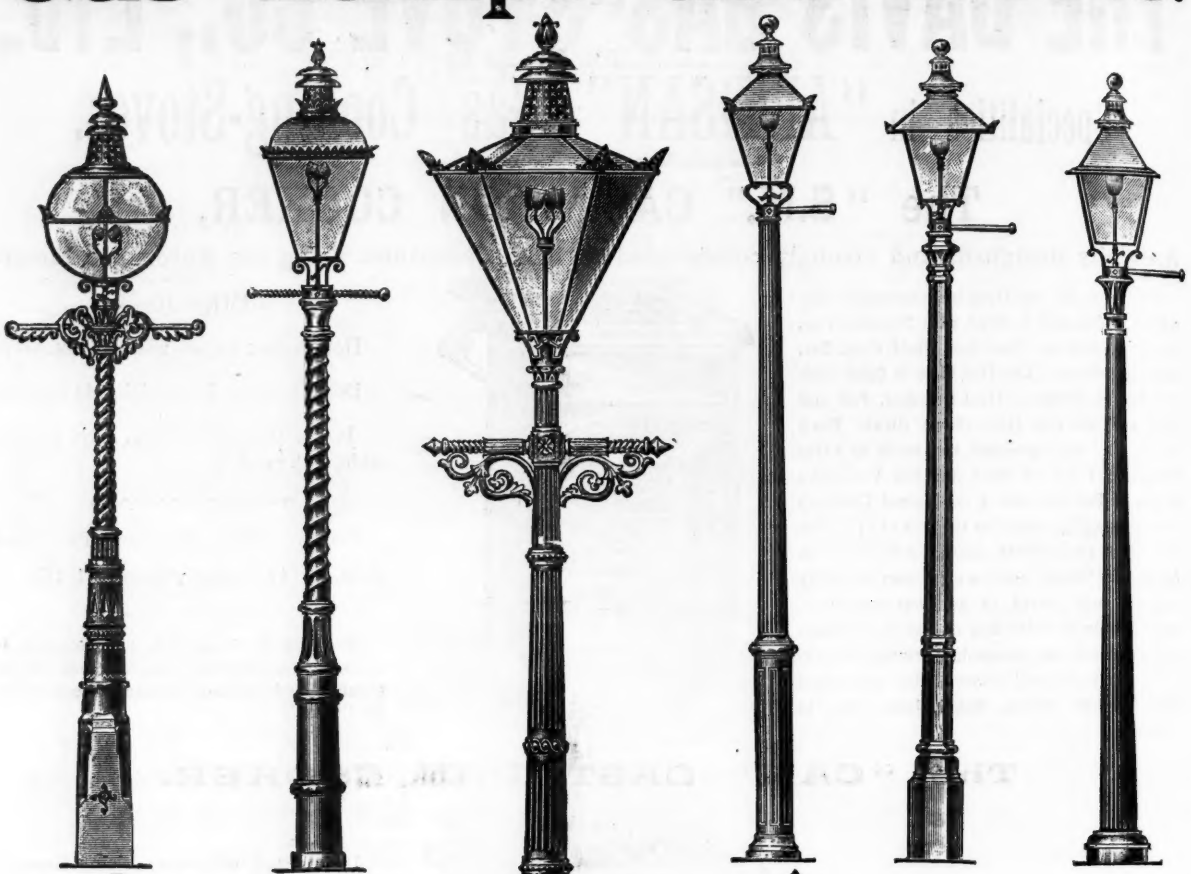
SIZE OF OVEN INSIDE.

High.	Wide.	Deep.
15 in.	14 in.	11½ in.

Price - - - £1 15s.

Offices & Works: CAMBERWELL. Show-Rooms: 59, QUEEN VICTORIA STREET, E.C.

Gas Lamps and Posts.



Patent Street Lamps.

NO PUTTY.

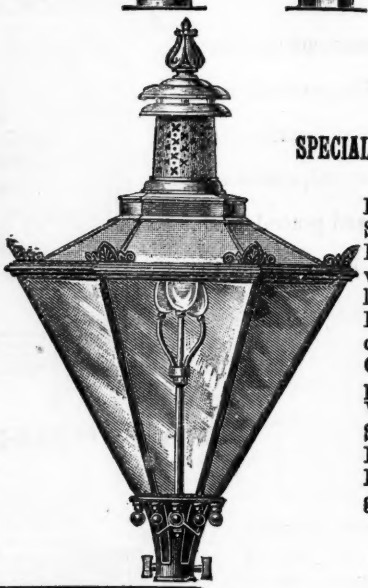
Several thousands of these are now in use, giving general satisfaction. They are strongly made, and of best material.

Lamplighters' Torches.

Lever Taps.

Lamp Governors.

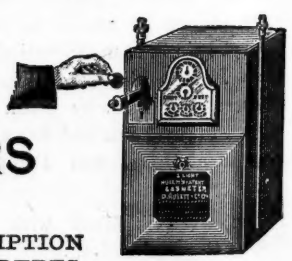
PRICE LIST ON APPLICATION.



SPECIAL HIGH-POWER LAMPS.

For Lighting Streets, Refuges, Promenades, &c., where a good light is required. Fitted with Porcelain cone, Copper top and perforation, Wrought-Iron Spray, Lever Tap, Burner and Patent Governor, glazed with Opal top.

GAS-METERS.



PREPAYMENT METERS

(PRICE'S PATENT)

SPECIALLY ADAPTED FOR INCREASING CONSUMPTION AMONG SMALL CONSUMERS. NO RISK OF BAD DEBTS.

D. HULETT & Co., Ltd.,

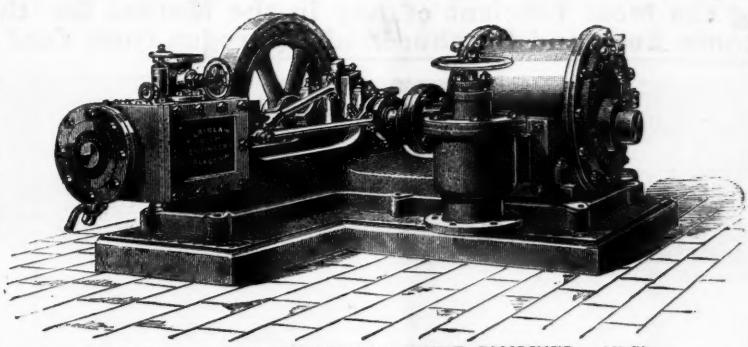
55 & 56, HIGH HOLBORN, LONDON.

R. LAIDLAW & SON,

GAS AND WATER ENGINEERS.

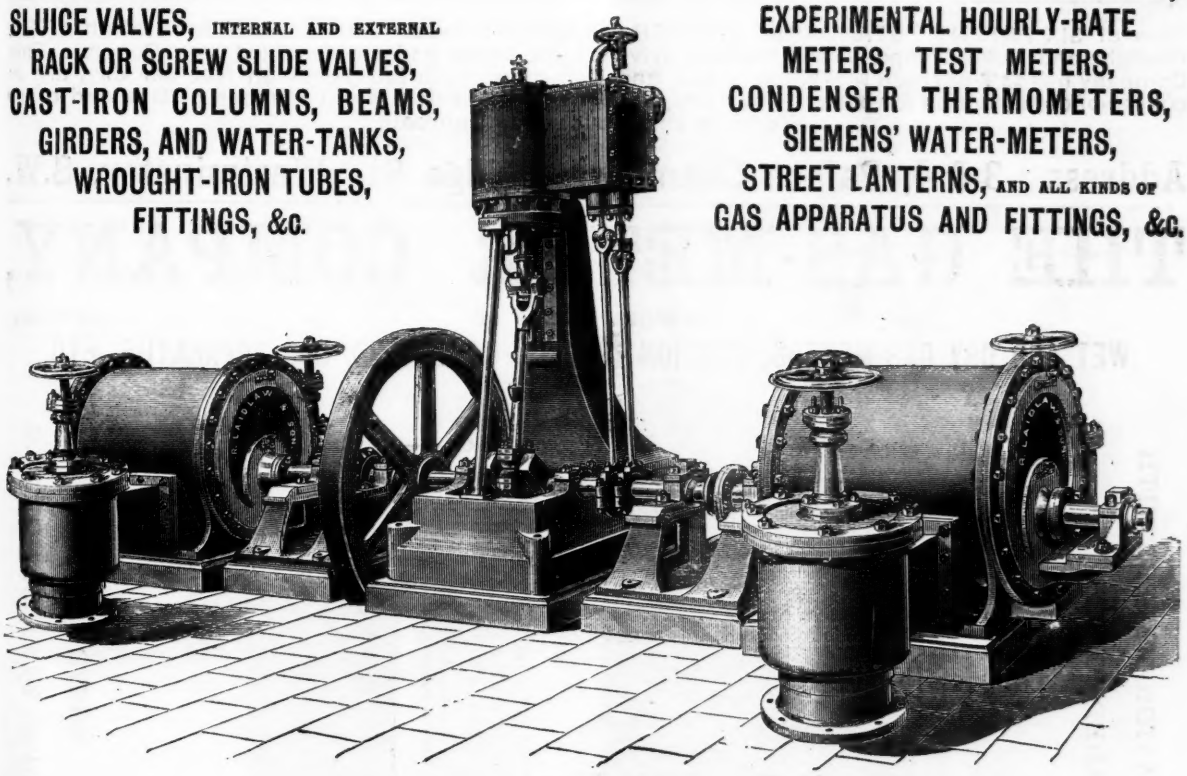
Manufacturers of **GAS APPARATUS** of every Description.

Makers in Glasgow of
CAST-IRON PIPES, ALL SIZES,
LAMP PILLARS,
STEAM-ENGINES AND BOILERS,
PUMPING-ENGINES For Water-Works.
BEALE'S GAS EXHAUSTERS,
DOUBLE-FACED SLUICE VALVES, INTERNAL AND EXTERNAL
RACK OR SCREW SLIDE VALVES,
CAST-IRON COLUMNS, BEAMS, GIRDERS, AND WATER-TANKS,
WROUGHT-IRON TUBES, FITTINGS, &c.



BEALE'S GAS EXHAUSTER AND ENGINE COMBINED. All Sizes.

Makers in Edinburgh of
WET AND DRY GAS-METERS, IMPROVED
STATION GOVERNORS,
PRESSURE REGISTERS
PRESSURE GAUGES,
TEST HOLDERS,
EXPERIMENTAL HOURLY-RATE METERS, TEST METERS,
CONDENSER THERMOMETERS,
SIEMENS' WATER-METERS,
STREET LANTERNS, AND ALL KINDS OF
GAS APPARATUS AND FITTINGS, &c.



BEALE'S GAS EXHAUSTERS AND ENGINE COMBINED. All Sizes.

Prices, with full Particulars, will be given on application.

Two Gold Medals, One Silver Medal, One Bronze Medal, and Two Honourable Mentions,
INTERNATIONAL EXHIBITION, EDINBURGH 1886.

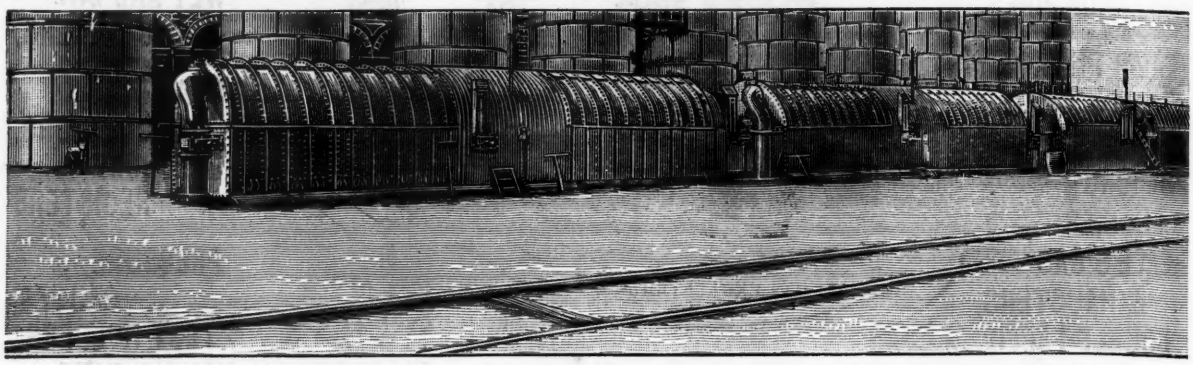
ALLIANCE FOUNDRY, **GLASGOW.** | SIMON SQUARE WORKS, **EDINBURGH.** | 6, LITTLE BUSH LANE, **LONDON, E.C.**

KIRKHAM, HULETT, & CHANDLER, LD.,

Patentees of the

PATENT "STANDARD" WASHER-SCRUBBER.

☞ **467 of these Machines (capable of dealing with 447,807,000 cubic feet of Gas daily) have been supplied, which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen from Coal Gas.**



View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company (the Engines driving same being under Galvanized Iron Covers). This Company has **27** of these Machines in use, and Two more, each for 3½ million feet per day, are in course of construction for them. They are also in operation at a great number of Gas and other Works in this Country and abroad.

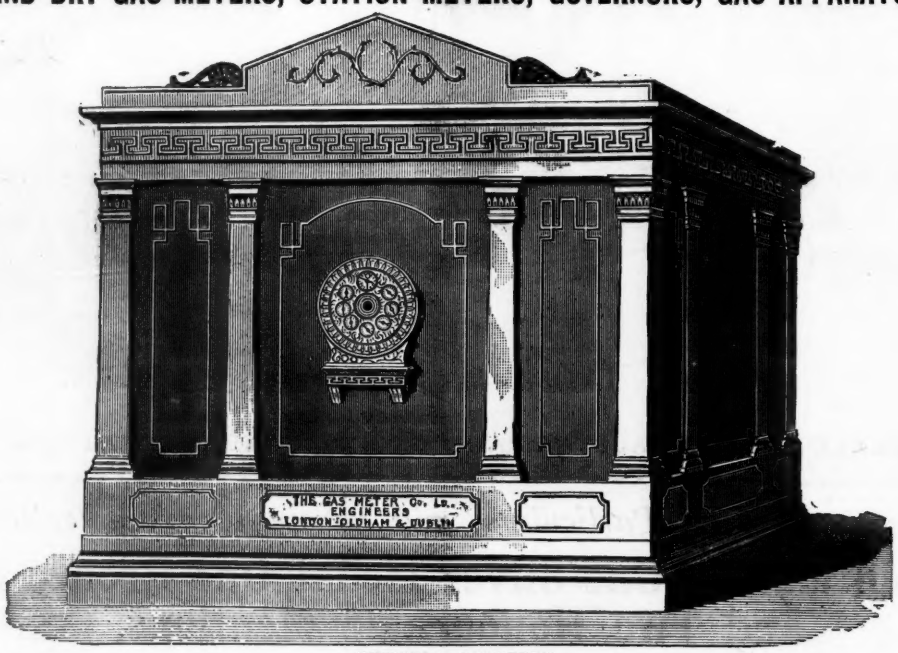
Address : 3 & 4, Palace Chambers, Bridge St., Westminster, S.W.

THE GAS-METER COMPANY,

MANUFACTURERS OF LIMITED,

WET AND DRY GAS-METERS, STATION METERS, GOVERNORS, GAS APPARATUS, ETC.

SQUARE STATION METERS WITH PLANED JOINTS.



STATION METERS IN CYLINDRICAL CASES.

DESIGN No. 2 PATTERN.

STATION METERS MADE AT THE COMPANY'S WORKS, OLDHAM, LATE WEST & GREGSON, Established 1830.

For Prices and Particulars apply to

R. L. ANDREWS, General Manager.

Works: 238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

Telegraphic Address: "METER."

(See Advertisement on back of Wrapper.

TELEGRAPHIC ADDRESS:
"ROBUSTNESS LONDON."

GAS & WATER
WORK
J. & H. ROBUS,
ENGINEERS & CONTRACTORS,
20, BUCKLERSBURY LONDON, E.C.,

furnish Plans, Estimates, and Specifications for SINKING BOREHOLES *and* WELLS; *Erecting* RESERVOIRS, FILTER-BEDS, *and* GASHOLDER TANKS; *and* EVERY REQUISITE *for* GAS *and* WATER WORKS,

INCLUDING

MAIN LAYING

EXCHANGE TELEPHONE 1756.

L. W. LEEDS' PATENT
FLOOR-WARMING GAS-STOVES.

BEWARE OF IMITATIONS.

None Genuine unless branded "L. W. LEEDS PATENTS."

HERSEY BROS., LTD.,
70, BERNERS STREET, LONDON, W.
(LONDON OFFICE OF L. W. LEEDS.)

INCLINED RETORTS,
FIRE BRICKS,
LUMPS, TILES,
BLOCKS, &c.
Special Bricks for Intense Heats.

GAS RETORTS.

CASTINGS AND EVERY REQUISITE FOR GAS-WORKS.

MOBBERLEY & PERRY,
Fire-Brick Works, STOURBRIDGE.
☞ Retort Setters sent to any part of the Kingdom.

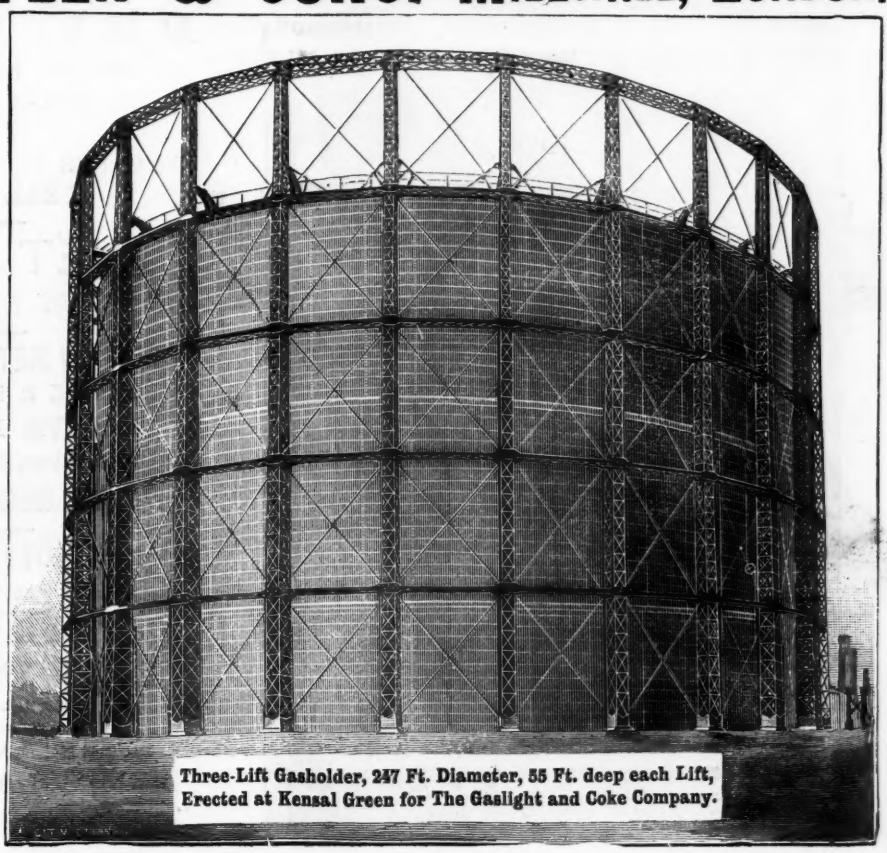
SAML. CUTLER & SONS. MILLWALL, LONDON.

NEARLY

8 MILLION

CUBIC FEET

CAPACITY.



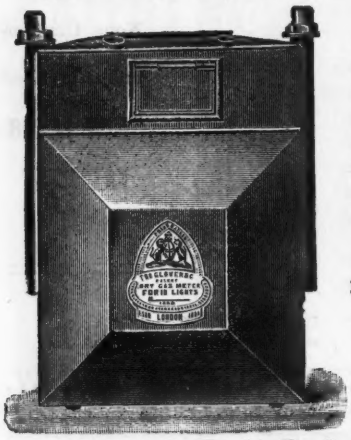
Three-Lift Gasholder, 247 Ft. Diameter, 55 Ft. deep each Lift, Erected at Kensal Green for The Gaslight and Coke Company.

[ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;

The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.



1st.—Are a remedy for all the defects of Wet Meters.
2nd.—Are suitable for all Climates, whether hot or cold.
3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe.
5th.—Are the most accurate and unvarying measurers of Gas.
6th.—Prevent jumping or unexpected extinction of the Lights.
7th.—May be fixed either above or below the level of the Lights.
8th.—Cannot be tampered with without visibly damaging the outer case.
9th.—Will last much longer than Wet Meters.
10th.—Will not cost more than one-half for repair that Wet or Water Meters do.

Are upheld for five years without charge.

Telegraphic Address: "GOTHIC LONDON."
Telephone No. 6725.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

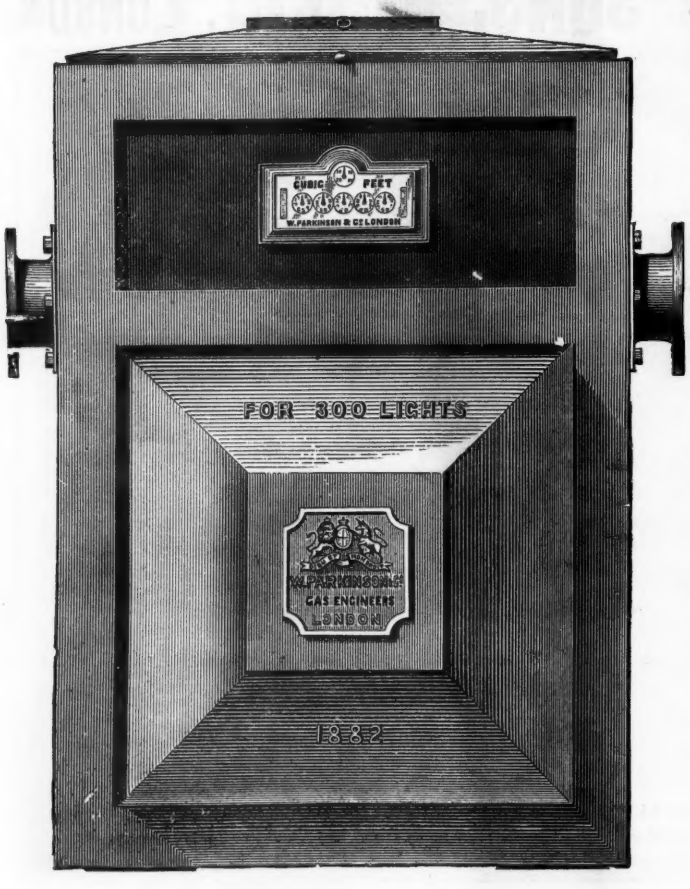
BRISTOL: 62, VICTORIA STREET. *Telegraphic Address: "GOTHIC."*

BIRMINGHAM: 3, BRIDGE ROW, DERITEND. *Telegraphic Address: "GOTHIC."*

LEEDS: BOAR LANE CHAMBERS, 4, BASINGHALL STREET. *Telegraphic Address: "GOTHIC."*

MANCHESTER: 87, BLACKFRIARS STREET. *Telegraphic Address: "GOTHIC."*

W. PARKINSON & Co.



MANUFACTURERS OF

DRY METERS

OF THE VERY BEST QUALITY.

The DIAPHRAGMS are of the Finest PERSIAN SHEEP SKINS.

The CASES are of the Best CHARCOAL-TINNED PLATES.

WET METERS,

With PATENT THREE-PARTITION DRUMS.

STATION METERS AND GOVERNORS.

PRESSURE & EXHAUST REGISTERS,

MOTIVE POWER METERS,

Test Gasholders, Experimental Apparatus, &c.

PRESSURE GAUGES OF EVERY DESCRIPTION.

NEW ILLUSTRATED CATALOGUE AND PRICE LIST

Sent post free on application.

COTTAGE LANE WORKS, CITY ROAD,

LONDON.

Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS, **BIRMINGHAM.** Telegraphic Address: "GAS METERS."

10, MAWSON'S CHAMBERS, DEANSGATE. **MANCHESTER.** Telegraphic Address: "PRECISION."

CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE
The Chartered Company's Meeting . . . 275
Manchester Corporation Gas—The Committee's Defence . . . 276
Mr. M'Laren and Employers' Liability . . . 276
A Costly Arbitration . . . 277

ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 277
Electric Lighting Memoranda . . . 277
Donkin on Internal Combustion Motors . . . 278

NOTES:—
A Lecture Experiment . . . 279
A Corrected Value for Joule's Equivalent . . . 279
A Chemical Combination Retarded by Moisture . . . 279
Gas Storeage Cylinders . . . 279
The Composition of Air . . . 280

TECHNICAL RECORD:—
The Incorporated Institution of Gas Engineers—The Annual Meeting . . . 280
The Chemical Technology of Coal Gas. Lectures by Professor V. B. Lewes, F.I.C., F.C.S.—III. The Destructive Distillation of Coal . . . 280
Coal in Colombia . . . 283
Gas-Burners and the Comparative Cost of Gas and Electric Lighting . . . 284

LEGAL INTELLIGENCE:—
Supreme Court of Judicature—Court of Appeal—Green and Haydon *v.* Chelsea Water-Works Company . . . 285
High Court of Justice—Chancery Division—*In re* the Buckfastleigh Gas Company, Limited . . . 285
High Court of Justice—Queen's Bench Division—The Gas Lighting Improvement Company, Limited, *v.* The Tottenham and Edmonton Gas-light and Coke Company . . . 285

MISCELLANEOUS:—
Meeting of The Gaslight and Coke Company . . . 286
Brentford Gas Company—The Half-Yearly Report and Accounts . . . 288
Newcastle and Gateshead Gas Company—Annual Report . . . 288
Provincial Gas and Water Companies . . . 289
The Gas Question in Dublin—A Discussion in the City Council . . . 290
Manchester Corporation Gas Supply—The Gas Committee's Reply to Mr. Southern's "Memorandum" . . . 291
The Public Lighting of Birmingham . . . 293
The Lighting of Blackpool—Extension of the Electric Lighting Plant and of the Gas-Works . . . 293
Bury Corporation Gas Supply—The Differential Rate . . . 293
The Transport of Petroleum in Bulk . . . 294
The Welsh Water Scheme of the Birmingham Corporation—The Request for a Local Inquiry Refused . . . 295
Artesian Well and Surface Waters . . . 296
Notes from Scotland . . . 297
Current Sales of Gas Products . . . 298
Coal Trade Reports . . . 298
Gas and Water Companies' Stock and Share List . . . 300

PARAGRAPHS.—The Directorate of the Croydon Gas Company, 277—Southern District Association of Gas Engineers and Managers, 277—Professor Lewes's Lectures on the Chemical Technology of Coal Gas, 277—Presentation to Mr. F. Lee, 278—Reports of Gas Associations, 1893, 278—The Spontaneous Combustion of Coal, 279—The Discovery of Coal at Dover, 279—Society of Engineers, 279—Institution of Civil Engineers, 280—Death of Mr. T. H. G. Berrey, 280—The Federated Institution of Mining Engineers, 280—Boiler Incrustations and Deposits, 280—Trade Catalogues, 283—A New Filling Material for Thermometers, 283—East London Water Company, 285—Indignant Gas Consumers at Holyhead, 285—The Kendal Corporation and the Gas and Water-Works, 285—The Use of Gas for Railway Carriage Lighting, 288—The Proposal to Establish Municipal Gas-Works at Liverpool, 288—A Social Gathering at the Dover Gas-Works, 288—The Pretended Meter Inspector, 293—Annual Dinner of the Liverpool Gas-Meter Inspectors, 294—Reduction in the Price of Gas at Dover, 294—Rugeley Water Scheme, 295—The Bodmin Water Company, 299—Gas-Works Extensions at Burnley, 299—The New Machinery at the Manchester Gas-Works, 299—The Leicester Corporation Electric Lighting Scheme, 299—Sales of Shares, 299—Exhibition of Gas Appliances at Norwich, 299—Sittingbourne Water Supply, 299—The Accident through an Electric Current at Bournemouth, 299—Bolton Water-Works Extensions, 299—The City and Guilds of London Institute, 299—Encouraging the Use of Gas at Bury, 299—Gas Companies and Electric Lighting in France, 299—Proposed Extension of the Wigan Water-Works, 299—The Late Water Engineer of Nottingham, 299—The Electric Lighting Question at Harrogate, 299—The Bridgnorth Town Council and the Divining-Rod, 299—The Bexhill Local Board and the Gas and Water-Works, 300—The South Metropolitan Gas Company and the Proposed Reduction of Illuminating Power, 300—Chesterfield Water and Gas Bill, 300.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

Post-Office Orders should be made payable at the Chief Office, St. Martin's-le-Grand; Cheques crossed "Union Bank of London," and drawn to the order of WALTER KING, 11, Bolt Court, Fleet Street, E.C.

Telegraphic Address: "GASKING LONDON."

Telephone Number: 2789.

THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, FEBRUARY 13, 1894.

The Chartered Company's Meeting.

THE meeting of The Gaslight and Coke Company last Friday was well attended; and the character of the proceedings must have been very gratifying to the Board, for the Governor—Colonel Makins—was in capital form, and had everything his own way from start to finish. His speech, in moving the adoption of the report and accounts, was long and decidedly laboured. It must have been a great relief, both to the speaker and his colleagues, when it was over; as the delivery appeared towards the last to strain the Governor's always clear and distinct, but never strong, voice. The address occupied fully forty minutes out of the bare hour that sufficed for the whole business of the meeting; and there were no critics. It went over the whole field of the Company's operations, and dealt in a painstaking spirit with every aspect of the internal working of the undertaking, and every point of contact with the public, which have formed subjects of recent remark or controversy. If anything, it was too apologetic in tone. But it is now some years since Colonel Makins made up his mind to rest on the defensive, and, with regard to the affairs of the Company, to "speak only when spoken to." It might be wished that he could sometimes take a wider view. His speech was fuller of figures than was usual in past years; and very interesting and curious some of these figures are, even though they are not always so convincing as they are meant to be.

The new Secretary and General Manager—Mr. John William Field—is a renowned gas undertakings accountant; and his style of getting up a case is repeatedly shown in the matter with which he, as in duty bound, provided the Governor for Friday's effort. Everything Colonel Makins advanced was clinched with a quantity or a ratio; and in some respects this apt citation of statistics fairly supported the argument. Deftness in the manipulation of figures, however, is often a snare; and the professional statistician frequently needs to be reminded of the truth of the hackneyed saying that "figures can be made to "prove anything." It is quite in order to take some of the figures that can be extracted from the books of a gas undertaking, and use them in support of an explanation or an excuse. But the questions remain as to how such figures came to be there, and whether others might not be equally available to prove some totally opposite contention. This consideration needs to be borne in mind when some parts of Colonel Makins's speech are passed in review.

It is satisfactory to be assured that the weak places in the Company's manufacturing and storeage arrangements are in a fair way of being made good. As was stated in this column last week, the temporary falling off in the consumption of gas in the Chartered district does not absolve the management from responsibility for making ready to meet the increased strain which a concatenation of circumstances may throw upon the plant at any moment, and which is certain to come sooner or later. Colonel Makins took up the explanation of the nature and operation of this responsibility where we left it; giving additional reasons to prove that a check in gas consumption does not conduce to economical working. In more than one respect, the heads of our last week's article on the report and accounts came in useful as texts for the Governor's pronouncement. Colonel Makins is always careful to be "up to date" in his official utterances; and it was like him to make special reference to a report in *The Times* of Friday respecting the formation of a "ring" among the gas coal producers of the North of England, with the object of keeping up prices as against the Gas Companies. He argued with much force against the idea that such an operation is possible. It is true that no arrangement of the kind ever lasts long; but it is equally true that such devices give a deal of trouble now and again, until circumstances render them unavailing. Colonel Makins was fain to play off carburetted water gas against the alleged machinations of the gas coal trade. He went on to refer to the question of rates and taxes in terms which, to say the least, will not command universal approval; and he said something very polite about the Gas Referees and their efforts in the way of specifying candles for testing purposes.

The gem of the speech was reserved for the last. It was led up to by some good-humoured remarks respecting Mr. Rowland's "League" of gas consumers; and yet another explanation, for the benefit of the public, of the action of the sliding scale, about which it is quite possible that the "young lions" of the London County Council may know nothing at all. It consisted of a carefully-prepared "Memorandum," read with great emphasis by the Governor, and designed to so explain the reasons for the difference of price at the present time between the Chartered and South Metropolitan Companies as to persuade the public of Northern and Central London that these arise out of the nature of things, and must therefore be endured without hope of change. We refrain

from spoiling this wonderfully clever bit of specialized statistical work by any paraphrase. It is to be studied and appreciated as it stands in our report. We shall not criticize it—at any rate, for the present. It is a splendid example of what was said just now as to the speciousness of argument upon figures. The full beauty of this work of art can only be appreciated when it is known that the master set himself to account for a difference of 7·21d. in the prices charged for gas by the two Companies; and he actually succeeded in doing so up to 7·20d.—thus reducing all controversy to a matter of the one-hundredth part of a penny! It is to be regretted that the same result was not obtained, by way of corroboration, by reference to the working conditions of the remaining London Gas Company. And, of course, as to the accuracy of the computation, there can (in the words of Gilbert) be "no possible, probable shadow of doubt—no possible doubt whatever!"

We congratulate Mr. John Orwell Phillips upon his accession to a seat at the Board, which was arranged for and carried out in the neatest possible way; and to the complete satisfaction of all concerned. It should be stated that a feature of the day was a "private view" of the portrait—a speaking likeness—of the late Secretary and General Manager, presented to him by his quondam colleagues and fellow-officers of the Company. This was exhibited at the top of the staircase leading to the Board-room, and was duly admired by the large proportion of proprietors who took the opportunity of inspecting it.

Manchester Corporation Gas—The Committee's Defence.

THE Manchester Corporation Gas Committee have taken their critic, Mr. J. W. Southern, very seriously. It will be remembered that in a "Memorandum" which we published on Dec. 12, Mr. Southern formulated a very strong indictment of the administration of the Gas Department of the Corporation, of which he is not the least distinguished member. The matter was mentioned incidentally at a meeting of the City Council at the time, when the Chairman of the Committee, with the object of discounting any effect that Mr. Southern's statement may have had on the public mind, declared that the Committee would be quite prepared to meet and dispose of what he called Mr. Southern's "charges." The very argumentative and detailed report which will be found in another column is the official reply of the Committee. The matter was to have been discussed at the last meeting of the Council; but it was not reached, and may or may not be disposed of at the next meeting, which is fixed for to-morrow week. As we remarked when last dealing with the subject in these columns, it is the "cue" of all municipal departments to fence with every suggestion that all is not for the best in that best of all possible little worlds of which they have charge. A private censor of any gas-works administration, municipal or otherwise, must always be at enormous disadvantage when attempting to pierce the hide-bound body to which he directs his criticisms. He is but one against a host, every one of them as able (in a general way, as himself) and all fortified by a strong bureaucratic spirit, and supplied with such ample stores of ammunition in the form of figures and illustrations calculated to weigh with the judge—in this case uninstructed public opinion—that it is no wonder if officialism triumphs again and again. In the case of Manchester, the Committee complain that Mr. Southern has misquoted Field's "Analysis" to their disadvantage; but they appear to admit that, with an amount of interest-bearing capital of less than one-third that of Birmingham, they cannot sell gas at less than 4⅛d. per 1000 cubic feet in excess of the average price received in the Midland city. This is a pretty weighty admission to start with. It will be noticed that the Committee are not above "cooking" a figure when it suits their purpose to do so; since, in order to minimize this contrast, they charge Birmingham with the amount of the discounts for prompt payment, which certainly does not serve the Gas Department as revenue. Then, the idea of putting Manchester gas at the high illuminating power of 19·55 candles, in view of their testing arrangements, is almost ludicrous. It is impossible, however, to take all the points of the Manchester working in order, and show how much better it might be, without having equal power with the Committee to "send for persons and papers," and so trace out the inner working of the concern. Mr. Southern cannot do this; and the Gas Committee do not mean to give anybody an opportunity for doing so. They will consequently, in all probability, defeat Mr. Southern upon a division, and thereafter go on just as before. The tribunal to which both parties appeal has full jurisdiction in the matter, but no knowledge. What the Committee ought to do, unquestionably, is to consent to an independent and authoritative inquiry. They may bowl over Mr. Southern; but that feat will not help in the slightest degree to rehabilitate the Manchester gas-works administration in the good opinion of those who are qualified to judge of such matters. What is, perhaps, even more to the point, is the reflection that the discomfiture of Mr. Southern, upon which the Department in all probability reckons with much pleasurable anticipation, will not help Manchester to good gas at 2s. per 1000 cubic feet, which is the city's due.

Mr. M'Laren and Employers' Liability.

THE circular issued by Mr. M'Laren, M.P., to those of his colleagues in the House who voted for his proposition to except existing insurance funds from the operation of the Employers' Liability Bill, in view of the return of this measure from the Lords with the Earl of Dudley's revised amendment, is a magnificent specimen of present-day "opportunism." The member for the railway men of Crewe informs his friends that, unless some compromise can be arrived at, the Bill will probably be lost. This is as much as to say that, in order to please Mr. John Burns and the militant Trade Unionists, who "have their knife "in" the best employers of labour in the country, the Government will drop a measure which both the great parties in Parliament would on other accounts gladly pass into law. Mr. M'Laren's constituents will not have the Bill with the Trade Union clause in it at any price; and consequently it strikes their representative that the "most "reasonable"—meaning the most expedient—course will be to restore his original proposition to spare existing mutual insurance societies. Mr. M'Laren remarks that "the members of these societies desire their continuance; "but there is no evidence of a desire that contracting out "should be allowed elsewhere." This is latter-day statesmanship in all its nakedness! A thing that exists is to be permitted to continue because certain voters would like to have it so. There is no question of good or bad about this proposition. No attempt is made to base the suggestion upon the datum of the satisfactory working of existing arrangements; for the very good reason that if this course were taken there could be no valid objection raised to the prospective extension of the system. "Let them "have it, because they like it," is Mr. M'Laren's argument, and his only one. He credits his constituents with sharing his own callous indifference to the prospective wishes of other voters who do not yet happen to enjoy a share in a mutual insurance fund. It never occurs to him that what has been found so satisfactory to the London and North-Western Railway men may be worth extending to other large industries. There is no evidence of a desire for contracting out, outside the existing societies; but how could there be evidence of a desire for anything from societies which do not exist? It is the prevalence of this miserable, hand-to-mouth expediency among members of the House of Commons which is responsible in an eminent degree for the barrenness of the past year. One honourable gentleman is pulled this way by his constituents, another is drawn in a diametrically opposite direction; and there are few who confess to understanding, while there are still fewer who stick to definite principles. The House of Lords, in preserving for adult Britons their privilege of entering into whatever contracts they conceive to be good for them, and in protecting the best employers from the machinations of political Trades Unions, are making a stand for Freedom. Not the most hare-brained demagogue who vents cheap rancour against an order which does not want his vote can allege that it will make the smallest difference to the House of Lords whether contracting out is permitted or not. The cry of class interest cannot be raised in this case; yet the clamour against the Peers for daring to interfere with an Employers' Liability Bill is quite as loud in the land as though their Lordships had again refused to legalize marriage with a deceased wife's sister. It will be interesting to watch Mr. M'Laren through his performance in the House; but the issue is of no great moment. For if the Government should decide upon dropping the measure in view of the obstinate persistence of the Upper House in being logical, nothing worse will

happen than a postponement of legislation on the subject until another Administration succeeds to power, when all the really valuable provisions of the Bill will be recast in another measure, and passed without opposition.

A Costly Arbitration.

COMPLAINTS are occasionally heard as to the costliness of arbitrations; and both Gas Companies and Local Authorities have not infrequently been mulcted heavily in expenses for settling disagreements about transfers, contracts, and damages. It would appear, however, that something very like a "record" in extravagant arbitration proceedings has lately been established by the Local Board of Teddington, Middlesex, and their late main-drainage contractors, in connection with a disputed claim by the latter for a sum of about £12,000. The amount in dispute cannot be properly described as a trifle; but the arbitration could scarcely have been a bigger thing of the kind if the cost of the Manchester Ship Canal had been at stake. Mr. J. Wolfe Barry was the Arbitrator; and the sittings went on for twenty-eight days, vastly to the solace and amusement of a large number of highly respectable Great George Street gentlemen. Eventually the Arbitrator decided in favour of the contractors to the extent of £10,720; and consequently their claim could not have been far from just. The costs, amounting to nearly £5000, were ordered to be paid by the Local Board; and, although the result of the affair was somewhat of a "staggerer" for this unfortunate body, they have been advised by a Committee, to whom the award was remitted for consideration, not to take any further steps with the object of setting it aside, but to apply to the Local Government Board for a loan to clear off the liability. It is difficult to discover a single redeeming feature in these outrageous proceedings. Although the contractors are in the happy situation of those who laugh last, having obtained nearly all they wanted, they must have felt keenly the annoyance and trouble, besides the expense and the delay, to which they were put in the endeavour to secure their own. The Local Board must be commiserated with; for it is hardly conceivable that the members would have refused to pay their contractors' bill without what they at least regarded as good reason. As for the Arbitrator and the lawyers and experts, it is not to be supposed that these worthy and clever gentlemen did anything out of the common in making the settlement of a technical dispute cost half as much as the sum at issue. It is, of course, the system which is at fault. If people will quarrel over contracts, and will engage the bigwigs of the legal and engineering world to do their business for them, they must be prepared to pay handsomely for the privilege. All the same, the ratepayers of Teddington are to be pitied in this instance. They will not have smarted in vain, however, if ratepayers' representatives elsewhere take warning from their harsh experience, and steer clear of similar troubles.

The Directorate of the Croydon Gas Company.—Dr. T. Rutherford Adams, J.P., has been elected a Director of the Croydon Gas Company in place of the late Mr. H. Chasemore, whose death was recorded in the JOURNAL on Nov. 7 last.

Southern District Association of Gas Engineers and Managers.—The annual meeting of this Association will be held next Thursday at the Holborn Restaurant. We learn from the circular issued by the Honorary Secretary (Mr. J. W. Helps, of Croydon) that, as usual at the first assembly in the year, the business will consist of the presentation of the Committee's report, and the delivery by the President (Mr. H. Smythe, of Maidstone) of his Inaugural Address. After the meeting, the members and friends will dine together.

Professor Lewes's Lectures on the Chemical Technology of Coal Gas.—We give elsewhere a report of the third of the series of lectures on the above subject now in course of delivery by Professor Vivian B. Lewes, F.I.C., F.C.S., at the Stratford Town Hall. Having in that discourse shown how gas is produced by the destructive distillation of coal, Professor Lewes will to-night explain how it is freed from impurities. Next Tuesday's lecture will be specially interesting from the fact that the question of enrichment will be dealt with. The use of cannel for this purpose will be first noticed; and then the various oil processes will be described. The precautions necessary to be taken during enrichment, and in judging of the effect produced, will be explained. Some observations will then be offered on the stratification of gases, and on the enrichment of coal gas by carburetted water gas; and the lecture will close with a few remarks on processes which have been proposed in England, and the causes of their failure.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 300.)

THE stock markets have continued quiet during the past week; the revival of enterprise remaining still among the possibilities as yet unattained. The tendency has been somewhat variable. Government and other choice securities have been firm; rails have been steady; and the Foreign Market has been fair, in spite of some rather disquieting incidents. The chief feature of the week has been the great drop in silver, which has now reached an unprecedentedly low figure, and has carried down with it everything that comes within the sphere of its influence as a monetary standard. The fall was inevitable, although it had been temporarily postponed by artificial measures; but none of these will avail to maintain permanently a false position. Happily there is ground for hoping that, when sound economic laws have been allowed to operate, a partial recovery will be effected. The Money Market has been fairly active and steady. The Gas Market has been very brisk and buoyant; and several considerable advances in quotation have been effected. In Gaslights, there was a good amount of business in the "A," at fairly steady figures, though the closing prices were not quite equal to the best of the week. Moderate business also was done in the secured issues; but quotations did not move. Only a single transaction was marked in South Metropolitans—stock being scarce; and the quotations, though considerably raised, not tempting sellers. Commercials were much more active; and both issues scored a nice advance. The Suburbans and Provincials were very quiet; nothing moved but British. All the Continentals were active, especially Imperial, which recovered 3 after its recent fall. Unions and European likewise rose. Among the rest, there was scarcely any movement; but the collapse in silver put Oriental a fraction lower. The Water Companies have been much quieter, but equally firm; and what few changes have occurred in the quotations are in the upward direction. The Kent Company meet to-morrow to declare an 11½ per cent. dividend—an advance of ½ per cent. upon the previous rate.

The daily operations were: Gas was not very active at the opening, except for dealings in Gaslight "A" and Imperial Continental, which last advanced 1. British also rose 1; but Oriental fell ¼. Business remained about the same on Tuesday, with a favourable tendency generally, though the only move was a further rise of 1 in Imperial Continental. Wednesday was almost a repetition of the previous day, and again Imperial Continental rose 1. Thursday was active and buoyant. South Metropolitan "B" improved 5; ditto "A" and "C," 3 each; and Continental Union preference, 2½. East London Water debenture stock was 3 higher. Friday was a fairly busy day; but prices did not alter. Saturday was quite quiet; but many further advances were effected. Commercial old rose 5; ditto new, 2; South Metropolitan "C," 2; and Europeans, ½ each. Lambeth Water 7½ per cent. gained 1.

ELECTRIC LIGHTING MEMORANDA.

The Dangers of the Electric Light on Shipboard—The Fortunes of the St. James's and Pall Mall Electric Light Company—The Lighting of the London School Board Offices.

THERE has been quite a small "scare" worked up over the *Pall Mall Gazette* "revelations" respecting the new danger to which ocean-going steamships are too frequently exposed through the scamping of electric light wiring. The fact has not been disputed; and it is admitted that electrically-lit ships are subjected to another danger apart from the fire-risk. It is roundly stated that the scamping of the work "has already started its death-roll;" the Secretary of the Shipmasters' Society declaring that he has been made aware of a number of fatal and other accidents which have been directly due to inferior electric light material. The trouble has arisen in the usual way, through the competition of contractors, who in many instances have been permitted to work without proper inspection. The consequence of letting these contracts to the lowest bidder has been to ruin the trade. Not only are the conducting wires insufficient in size, improperly placed, and insufficiently insulated, but the whole plant is often of the poorest quality; so that (in addition to the constant risk of setting the ship on fire) a failure of the electrical machinery might occur at any moment—thus plunging the whole ship into darkness and endangering her safety. There is a clamour for Board of Trade supervision of ship-lighting; and, in all probability, as soon as this is established there will be an outcry of electricians against it. The whole story is instructive to those who remember how loudly the electricians have, from time to time, protested against the imposition of any restrictions upon their performances on shore. They cried out against the Electric Lighting Acts, against the Fire Office rules, and against every set of Board of Trade regulations; and they argued that they must be credited with knowing their own business better than any regulating authority. On shore, however, the electricians were very soon brought under control in the interest of public safety, with the admitted result that British central station work is the best in the world. This means that the electricians have been forced

to do good work in spite of themselves. On the other hand, they have been given a free hand afloat, with the consequence that the ship-lighting branch of the trade is in a "vicious condition," as one of the correspondents of the *Pall Mall Gazette* avows. Apart from the technical interest of this subject, the contrast between electric lighting work afloat and on shore has a striking moral lesson concealed within it. We can here see the emptiness of the modern vaunt of "progress" in industrial matters, illustrated by the fact that the modern electrical engineer—the latest product of the union of science and industry—is liable to perpetrate the same old rogueries as those in which cheating tradesmen have indulged ever since the dawn of commerce. It is a grave trouble of modern civilization that science and honesty do not necessarily advance together.

The annual general meeting of the proprietors of the St. James's and Pall Mall Electric Light Company has lately been held, when the Chairman confessed that it was a matter of great regret on the part of the Directors that it was impossible to pay a dividend of more than 4½ per cent. on the ordinary shares. He had to complain, like the gas companies, of the brightness of the weather, which had checked the demand for light. This, however, was not the only grievance of the St. James's people. They also grumbled at having been obliged to lower their charges, in order to compete with the London Electric Supply Corporation, and at the "increased economy" shown by consumers, some of whom had practically succeeded in retrenching to the extent of 25 per cent. upon their earlier bills. This last consideration, as an electrical contemporary points out, means nothing more than that the consumers are discovering the economical use of the meter, which at first hit them very hard. It is not for suppliers of electricity to complain that their customers are at last beginning to treat electricity like every other commodity, and have accustomed themselves to make use of it with that frugality which is the parent of content. As we take it, however, the reality of the complaint of the Directors of the St. James's and Pall Mall Company goes deeper than a mere reproach to certain consumers. The management of the undertaking are at last in sight of the end of their scope. The increase in the number of lamps wired last year on the tally for the previous year, is stated at 25 per cent.—a respectable figure in itself, but exhibiting an ominous slackening of the demand as compared with the rapid growth of previous years. Next year the growth may be only half as much. Meanwhile, if the rental value of every lamp is reduced by the operation of the new-born spirit of economy with the best consumers, what are the prospects of the undertaking in regard to future dividends? Is the most richly dowered electric lighting company in the world, in the matter of district, to be content with a humdrum 4 per cent. dividend, or even less?

One potent reason why central station electric lighting does not pay better, is the tendency of their best prospective consumers to set up private installations. That this tendency is as strong as it ever was, may be gathered from the example of the electric lighting plant just completed for the enlarged offices of the London School Board, on the Thames Embankment. There are upwards of 1000 lamps in this important building, which is one of the ornaments of the river-front. The generating plant comprises two Babcock and Wilcox boilers, supplying a pair of Parsons' steam-turbines. Arrangements are provided whereby the waste steam can be utilized in the warming of the building if desired. Auxiliary storeage is provided by a battery of accumulators. The whole plant occupies very little space in the basement of the building; and it would be interesting to learn whether the steam-turbines are likely to give less annoyance by way of vibration and noise than ordinary steam-engines. The idea of working the electric lighting plant in connection with the steam-heating is ingenious so far as it goes; but it remains to be seen how the plan will answer in practice. Nothing is said in the published reports of this installation as to the existence of any "stand-by" connection with the mains of a central station electric lighting company; but these long-suffering concerns are habituated to such additions of "insult to injury"—in which, as a matter of fact, they share the lot of the gas companies, albeit at exceptional cost and inconvenience for which, in fairness, they should be permitted to recoup themselves by charging a kind of retaining fee, or by a higher scale of prices for services of mere convenience.

Presentation to Mr. F. Lee.—The newly-appointed Manager of the Marsden Local Board Gas-Works (Mr. F. Lee) was previously Chief Clerk at the Heywood Corporation Gas-Works; and his fellow-employees at these works have presented him with a marble clock and a copy of "King's Treatise on Coal Gas," as a mark of their esteem.

Reports of Gas Associations, 1893.—Our readers will see, by an advertisement which appears elsewhere, that the volume of reports of proceedings at the meetings of the various District Associations of Gas Managers in the past year is now ready. It is uniform in general appearance with its ten predecessors; but the contents have been augmented by the inclusion of the report of the spring meeting of the Waverley Association, at which some interesting particulars were given as to the working of the Young and Bell process. The letterpress is illustrated by twelve diagrams and two folding plates.

DONKIN ON INTERNAL COMBUSTION MOTORS.*

THERE is no topic of the day of greater interest to a large number of engineers and their customers among the ever-increasing section of the community capable of being classified as power users, than that of the condition and prospects of internal combustion motors; and the intelligence that Mr. Bryan Donkin, junr., has published a text-book on the subject should be a piece of good news to all who desire reliable, up-to-date information for their guidance in dealing in any capacity with this important class of power generators. Mr. Donkin's work is most timely; and we welcomed it at first sight as being just the kind of book for which everybody interested in its subject has been looking. For, as we thought at once, if Mr. Donkin cannot be trusted to tell the world all that need be known about any class of motor, where shall light be sought? It is the object of this notice to show our readers in what way, and to what extent, Mr. Donkin's book justifies the high expectation we formed of it from knowledge of the character and qualifications of the author.

The work is divided into three parts, treating respectively of gas, air, and oil engines. Part I.—"Gas-Engines"—is divided into two sections; the first being historical, and the second dealing with modern gas-engines. In writing these portions of his book, Mr. Donkin has made use of earlier works, the authors of which are duly named; and care has been exercised in giving a bibliography of every branch of the subject. The theory of the gas-engine is discussed in four chapters, in which task the author acknowledges having had the advantage of the remarks and valuable criticism of Professor Capper, of King's College, who has also made for the express purpose of publication in this work an exhaustive test upon the experimental Otto-Crossley gas-engine in the engineering laboratory of the College. For a chapter on the "Chemical Composition of Gas," Mr. Donkin has gone to Mr. G. H. Huntly, of the King's College Laboratory. It is only what might have been looked for in this author that he should not only have fully acknowledged the sources from which he obtained the assistance necessary to any writer of a text-book worthy of the name upon any branch of the highly specialized science of modern engineering, but have gone to the length of placing in the foreground of his work the names of all his helpers; so that he can never be accused of taking credit that does not belong to him. After all acknowledgments are made, however, the main work is that of Mr. Donkin; and by his part in it the book must stand or fall.

It may be observed here, parenthetically, that, although confessing to a deep interest in his subject, and holding a firm faith in the future of internal combustion engines, Mr. Donkin is no enthusiast to overlook the shortcomings of these motors. He admits in his preface that they still present a large field for economy, since "in both oil and gas engines about 40 per cent. of all the heat received now goes off in the exhaust gases, and almost 35 per cent.in the jacket water." The better the economic results obtained, he thinks, the greater will be the demand for these convenient motors. At present their chief recommendation is the absence of a boiler, which is a great advantage, especially for small powers. As they grow in size and improve in construction, Mr. Donkin believes that gas-engines will enter into formidable competition with the best steam-engines, and that "they may even constitute the principal heat motors of the future." This is not committing himself to very much; and one would willingly exchange such a vague half-prophetical expression for a more pointed statement dealing generally with the influence upon the gas-engine trade of the expiring of the Otto patent, and setting forth the actual state of the competition between steam and gas engines.

Mr. Donkin's first chapter is devoted to a general description of the action and parts of a gas-engine. Here we stumble at the outset over the word "caloric," which is stated to be the cause of motion in heat engines, and to be obtained in various ways. Surely it is time this term was dropped, like the idea which it was formed to express. Mr. Donkin is no purist in language, and does not always succeed in choosing the right word for expressing his meaning. Thus, in writing of the base-plate on which an engine is fixed, he describes it as being of cast iron, and usually "very solid"—obviously meaning that it is heavy. His method of arranging his matter at the commencement is also open to criticism, inasmuch as he plunges into the descriptions and discussion of details before disposing of general considerations. It is all very well for a writer of fiction to arrest the attention of his readers by beginning in the middle of his story; but in a technical work we favour the method of development. In writing the history of engines, we hold the most instructive plan is to start with the primitive machine, and working down to modern examples, without taking account of theory. Then the theory would come next; also treated historically; and the work would fittingly end with a critical description of engines as actually at work and in the market. Whether for good or for evil, Mr. Donkin has not followed this plan; and consequently his work appears to lack system. He does not get to the history of gas-engines before the third chapter of the book, with the effect that throughout the first two chapters he seems to be dealing with a mulitiplicity of things that are

* "A Text-Book on Gas, Oil, and Air Engines; or Internal Combustion Motors without Boiler." By Bryan Donkin, jun., M.Inst.C.E. With 136 illustrations. London: Charles Griffin and Co., Limited. 1894.

only to be understood upon the assumption that the reader already knows a good deal about the subject. When he does take his historical work in hand, it must be conceded that Mr. Donkin performs it luminously and comprehensively. His discussion of the earliest truly working gas-engines is highly informing; and he takes four chapters to cover the ground from Hautefeuille to Otto, who has a chapter to himself. The Atkinson engine is next explained, followed by the rest of the British patterns. Curiously enough, in endeavouring to account for the "great development of gas-engines within the last few years in England," Mr. Donkin only thinks of two circumstances—the first being the demand for gas-engines for driving dynamos in "country mansions," &c.; the second, the expiry of the Otto patent. It is remarkable he omits the fundamental fact of the situation—the low price of gas in England as compared with other countries. And it would be easy to exaggerate the influence of the "extensive and increasing application of electricity to lighting," of which Mr. Donkin writes, upon the development of the gas-engine trade; for in all probability the use of gas-engines in connection with electric lighting is not by any means their chief employment. We desire to recognize in the fullest degree the care with which Mr. Donkin has gone through the points of all prominent makes in gas-engines, British and foreign—giving diagrams and results of trials when obtainable. Although there are not two of these machines precisely alike, a scan of their different descriptions conveys an impression of great sameness, which is due to the fact of their being all designed upon the same principle, with the exception of two or three small machines like the Daimler and Capitaine high-pressure engines.

Mr. Donkin devotes a chapter to gas production for motive power; and he appears desirous of setting off the Lencauchez fuel-gas process against the well-known Dowson method. We have nothing to say respecting the author's statement of the theory of the gas-engine, or as to his investigation of the utilization of heat in this class of motor. These and other matters bearing upon the subject are discussed at considerable length, with careful reference to the latest published contributions to the literature of internal combustion motors, as it is evidently the author's desire to place before his readers all that has been done by way of elucidating the subject. It is unnecessary to criticize what Mr. Donkin has to say respecting petroleum and hot-air motors. In a valuable Appendix of many sections, the author gives Professor Capper's gas-engine test already alluded to, the importance of which can hardly be overrated; a translation of Beau de Rochas' description of his celebrated cycle; a list of gas, &c., engine patents covering the years 1884-92 inclusive; and a translation of Dr. Slaby's report on experiments with a twin-cylinder Otto engine in Berlin. The book has a full index.

Altogether, we can heartily recommend Mr. Donkin's work to all who are in any way interested in the internal combustion engines of the past and present. The book is a monument of careful labour; and nothing of any importance seems to be omitted by this conscientious compiler. The best of the author's own share in the work is his occasional criticism of the mechanical details of the different engines passed in review; and, as already remarked, the student would have been grateful for more of the same sort of instruction, not confined to mechanical details. One might paraphraze the lines of the drawing-room poet, and enquire: "Are the bonds for ever set, that shall keep the Ottos yet"—in their pride of place? We rise from the perusal of Mr. Donkin's book with the confirmed impression that, for the present at any rate, the gas-engine trade has got into a rut from which an even greater dead-lift than the Otto application of compression to the charge in 1876 will be needed to raise it. However, this is not the fault of the chronicler, who has to tell what the internal combustion cylinder is, not speculate as to what it might be, but has no apparent hope of becoming just yet.

The Spontaneous Combustion of Coal.—We learn from *Industries and Iron* that the *Deutsche Spediteur und Rhederei Zeitung* of Hamburg is offering three prizes of £250, £100, and £50 respectively for the best means, either chemical or mechanical, of preventing spontaneous combustion of coal in vessels.

The Discovery of Coal at Dover.—According to Professor Boyd-Dawkins, the strata at Dover have been pierced to a depth of 2181 feet below high-water mark, at which a seam of coal 4 feet thick was disclosed. In all, twelve seams have been proved; and he says "it is impossible to tell how many await discovery in the unknown region below." The Professor considers that the experimental stage is past, and all that remains is to develop the coal-field for the advantage of South-Eastern England.

Society of Engineers.—At the first meeting of this Society for the present year, which was held last night at the Westminster Town Hall, the retiring President (Mr. W. A. Valon, J.P.) presented the premiums awarded for papers read during the past session. Among them was the President's Medal. which was awarded to Professor Vivian B. Lewes, F.I.C., F.C.S., for his paper on "Gas Substitutes," read at the meeting of the Society on Oct. 2, and given in the JOURNAL on the following day. The new President (Mr. G. A. Goodwin) then delivered his Inaugural Address, which will be noticed in a subsequent issue.

NOTES.

A Lecture Experiment.

Mr. G. S. Newth, of the Royal College of Science, writes to *Nature* respecting a lecture experiment designed to illustrate the fact, stated in most text-books on chemistry, that when charcoal, which has been allowed to absorb as much sulphuretted hydrogen as it can take up, is introduced into oxygen gas, it will burst into flame owing to the energy of the action of the oxygen upon the sulphuretted hydrogen. The following is Mr. Newth's method for illustrating the reaction upon the lecture-table: A few grammes of powdered charcoal are introduced into a bulb which is blown in the middle of a piece of combustion-tube about 25 centimetres long. A gentle stream of coal gas is then passed over the charcoal, which is heated by means of an atmospheric burner until it is quite dry. This point may be ascertained by allowing the issuing gas to impinge upon a small piece of looking-glass; and when no further deposition of moisture takes place, the charcoal may be regarded as perfectly dry, when the heating is at once stopped. The charcoal is then allowed to cool in the stream of coal gas until the bulb can just be grasped in the hand, when the coal gas is replaced by a stream of sulphuretted hydrogen. In about 15 minutes, saturation will be complete. Up to this stage the experiment can be prepared in advance; and a very slow stream of sulphuretted hydrogen should be continued through the apparatus until the experiment is to be completed. This step consists in cutting off the supply of sulphuretted hydrogen, and replacing it with a stream of oxygen. Almost immediately the charcoal will become hot, and moisture will be deposited upon the glass. The supply of oxygen should be sufficiently brisk to carry the moisture forward from the charcoal, but not so rapid as to prevent it from condensing on the glass tube beyond the bulb. In a few moments the temperature of the charcoal will rise to the ignition point, when it will inflame and continue to burn in the current of oxygen.

A Corrected Value for Joule's Equivalent.

A communication has been made by Mr. E. H. Griffiths to the Royal Society respecting a correction of the usually accepted value of Joule's mechanical equivalent of heat. A statement on the same subject was made by the author a year ago, when it was promised that a careful comparison of thermometers would be conducted, so as to render the determination as final as the nature of such experiments permits. This comparison has now been made; and, as the result, Mr. Griffiths announces that the corrected value of the "Joule," in terms of a thermal unit at 15° C., is to be taken as $4{\cdot}1982 \times 10^7$ ergs, within an estimated limit of error equal to $\pm$ 0·0020. Hence, assuming that $g = 981{\cdot}17$ centimetres per second, the mechanical equivalent of one British thermal unit is 779·77 foot-pounds. It is remarkable that all the corrections and redeterminations of this physical datum made since Joule's day have had the effect of raising the value considerably. The equivalent was originally taken at 772·55 foot-pounds, on which the last determination is a sufficiently serious increase.

A Chemical Combination Retarded by Moisture.

It is almost a generalization of modern chemical science that chemical combinations proceed more actively in the presence of moisture, even when they are not wholly dependent on it. An interaction between oxygen and phosphoretted hydrogen, recently described by Dr. Van de Stadt, is, however, an interesting exception to the rule. The two gases instantly combine, with the appearance of flame, when they are allowed to mix under diminished pressure. The combination occurs in these circumstances in the proportions of two volumes of hydrogen phosphide to three volumes of oxygen; the product being phosphorous acid. When, however, the oxygen is admitted very slowly, or the two gases are allowed to mix by diffusion under a pressure not exceeding 50 millimetres, equal volumes appear to react with production of a greenish flame, liberation of hydrogen, and formation of a crystalline deposit on the walls of the vessel. When the pressure is gradually reduced, the gases combine explosively at a certain low pressure. All these different phenomena of combination between the two elements are greatly retarded by the presence of moisture.

Gas Storeage Cylinders.

It is remarked in the *Engineer*, in an article upon the construction of steel cylinders for storing gases under pressure, that nothing is known as to the effect of gases, some of them possessing great chemical activity, upon the steel with which they are in contact at high pressures often for months at a time. The only investigation of the kind that has been made was one undertaken by Brin's Oxygen Company. It was directed to ascertain whether internal corrosion of steel cylinders used for the storeage of compressed oxygen takes place to any serious extent; and it resulted in the conclusion that the alteration of the surface of the metal by the compressed gas is but slight. It is now suggested that effects more profound and less obvious than those of corrosion may be produced under conditions as severe as those operating in the case of a cylinder charged with oxygen at high pressure; and nothing but direct experiment, intelligibly planned and executed, can dispose of the point now raised. The same doubt arises, in equal or greater degree, in

connection with hydrogen and chlorine; both these gases being now procurable in the compressed state in steel cylinders, as ordinary articles of commerce. Hence it is argued that, until it is definitely proved that no alteration of the quality of the metal composing a gas cylinder takes place during a long period of use, there exists no guarantee that a cylinder, originally of unexceptionable quality, may not deteriorate, without showing signs of the change which it has undergone, and thus become a source of hidden danger.

The Composition of Air.

In connection with Professor Dewar's researches upon gaseous and liquid air, careful analyses of the composition of common air were specially made, with the following results, expressed in volumes per 1000: Nitrogen, 779·06; oxygen, 206·594; aqueous vapour, 14·0; carbon dioxide, 0·336; ammonia, 0·008; ozone, 0·0015; nitric acid, 0·0005. One would have expected to hear of the presence of sulphur in more than one form in air analyzed with such minuteness. The proportion of oxygen to nitrogen in the air of London was found to be the same at the surface of earth and at a height of 18,000 feet above it; being 20·885 : 79·115. On the American prairies, the proportion of oxygen rose to 20·910; and on the Pacific Ocean, to 20·965. In absolutely pure air, oxygen would be 21·026 to nitrogen 78·974 by volume; and a litre of it at 0° C. and 760 mm. pressure would weigh 1·2933 grammes. Under the same standard conditions, common air weighs 1·1512 grammes per litre.

Institution of Civil Engineers.—At the monthly ballot for members of this Institution last Tuesday, Mr. J. Goodman, of the Grand Junction Water-Works, Brentford, Mr. C. B. Newton, Gas Engineer of the Rotherham Corporation, and M. Paul le Juge de Segrais, of the Mare aux Vacoas Water-Works, Curepipe, Mauritius, were admitted as associate members.

Death of Mr. T. H. G. Berrey.—Last Tuesday, one of the oldest officials of the Manchester Corporation, Mr. Thomas Hope Green Berrey, passed away at the advanced age of 78. Deceased was best known in connection with the Water Department of the Corporation. In 1851 he was appointed Indoor Superintendent; and two years later he was instrumental in introducing the constant supply system in the city. On the death of Mr. C. Wilson in 1874, Mr. Berrey was made Chief Superintendent of the Water Department; and he took into his charge the entire management of both supply and distribution. In 1880, however, he was relieved of the financial part of his duties; and he then became General Outdoor Superintendent. Of a genial, kindly disposition, Mr. Berrey's relations with his staff were of a pleasant character; and some years ago they presented his portrait to the Water Committee.

The Federated Institution of Mining Engineers.—The members of this Institution will hold their fourteenth general meeting in Leeds to-morrow, under the presidency of Mr. Arthur Sopwith. We learn from the *agenda* which has been issued by the Secretary (Mr. M. Walton Brown) that among the papers to be presented on the occasion are the following: "The Geology of the West Yorkshire Coal-Field," by Professor Lupton; "Coal-Getting by Machinery," by Mr. F. Baum; "The Mexican Coal-Fields of Sonora and Chiapas," by Mr. J. Overend; "The Shale Oil Industry of France," by Mr. G. Chesneau; and "Spontaneous Combustion," by Mr. W. S. Gresley. In the evening the members will dine together. The following day will be devoted to excursions; and among the places which will be open to inspection will be Messrs. Pope and Pearson's collieries, the works of the Leeds Forge Company, the central electric lighting station, and the Yorkshire College.

Boiler Incrustations and Deposits.—This was the title of a paper read by Professor Vivian B. Lewes, F.I.C., F.C.S., at a recent meeting of the Junior Engineering Society. The subject was one upon which, from the special study he has given to the question, Professor Lewes was fully qualified to speak; and he treated it thoroughly from the chemical point of view. Having enumerated the substances which cause the formation of scale, he expressed the opinion that, with a very hard feed water, or a water containing ingredients which cause deposits, it is impossible to do much good in the boiler itself; and the most reasonable way of meeting the trouble is by treating the water, before it goes in, by some rapid method of precipitation and filtration. He advised caution, however, in the use of precipitants, as an excess would, he said, give rise to as much trouble in the boiler as if the ordinary lime salts had been present. In fresh-water boilers, incrustation could to a certain extent be prevented, or at any rate diminished, by the addition of substances which would prevent the calcic sulphate binding the calcic carbonate into a hard mass. These "anti-incrustators" might be divided into two classes—viz., (1) those having some definite chemical action, and (2) those which are purely mechanical in their operation. In the class of saline anti-incrustators, sodic carbonate generally plays the principal part; ammonic chloride and other alkalies and alkaline salts being also used. In the class of mechanical anti-incrustators, the number of organic compounds proposed or in use is very large. Professor Lewes concluded by saying that feed-water heaters act to a certain extent in softening the water supplied to boilers, and thus reduce incrustation; nearly half of the calcic carbonate contained in the water being sometimes deposited as mud in the heater.

TECHNICAL RECORD.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

In order to comply with the rules, a few of the members of the above Institution assembled at the Offices, No. 11, Victoria Street, Westminster, last Saturday, and transacted some of the ordinary business on the *agenda* for the annual general meeting. The PRESIDENT (Mr. John Methven, Engineer of the Beckton works of The Gaslight and Coke Company) occupied the chair.

CONFIRMATION OF MINUTES.

The SECRETARY (Mr. T. Cole) submitted his record of the proceedings at the last annual meeting; and it was approved.

ELECTION OF OFFICE-BEARERS.

The balloting-lists for the election of officers for the ensuing year were next examined; and they showed that the following gentlemen had been appointed:—

President—Mr. Alfred Colson, of Leicester.

Vice-President—Mr. C. C. Carpenter, of Vauxhall, London.

*New Members of Council**—Mr. J. F. Bell, of Stafford; Mr. J. W. Helps, of Croydon; Mr. G. T. Livesey, of London.

Auditors—Mr. Magnus Ohren, of Sydenham; and Mr. Alfred Lass, of London.

* The other members of Council are: Mr. E. Baker, of Reading; Mr. T. B. Ball, of Rochdale; Mr. W. Hardie, of North Shields; Mr. W. King, of Liverpool; Mr. R. O. Paterson, of Cheltenham; and Mr. H. Peaty, of Burslem.

A VOTE OF CONDOLENCE.

The PRESIDENT said he had the mournful satisfaction of proposing that the Secretary be requested to convey to Mr. A. Colson the sympathy of the members with him in the sudden bereavement he had sustained in the death of his son. He thought it was unnecessary for him to say anything further on the subject.

Mr. G. C. TREWBY (London) seconded the proposition, which was passed.

The PRESIDENT then announced that the meeting would be adjourned until Wednesday, May 9, at the Institution of Civil Engineers.

THE CHEMICAL TECHNOLOGY OF COAL GAS.

By Professor VIVIAN B. LEWES, F.I.C., F.C.S.

[A Course of Lectures delivered at the Stratford Town Hall.]

III.—*The Destructive Distillation of Coal.*

If we have to deal with liquids which can be vaporized by heat and again condensed by cooling, we call the process one of "distillation;" but if, out of contact with air, and under the influence of heat, a complex substance breaks up into simpler vapours and gases, it is called "destructive distillation." The process for obtaining illuminating gas, tar, &c., from coal comes in this category.

It has already been pointed out that bituminous coal may be looked upon as containing carbon and also simple hydrocarbons, such as some of the higher members of the paraffin series, more complex alcohol acids, and likewise organic bodies containing carbon, hydrogen, nitrogen, oxygen, and sulphur. On submitting a complex substance of this character to destructive distillation, it will be found that the yield and quality of the products will vary very considerably with the temperature existing in the retorts, with the size of the charge of coal used, with its distribution in the retort, with the length of time the distillation has been going on, and with an infinity of other factors of a more or less complex nature. The products will, however, in their main characteristics, remain the same. They may be divided into: (*a*) Solids, such as the coke and retort carbon; (*b*) liquids, consisting of the tar and ammoniacal liquor; and (*c*) gases, consisting of the unpurified coal gas.

The chief solid residue is not absolutely pure carbon, as it contains the mineral non-volatile constituents, which remain behind as ash when the original coal is burnt, and which, to a considerable extent, existed in the sap that filled the cells of the plants from which the coal was formed. The retort carbon found as a dense deposit on the crown of the retort by the action of the high temperature upon the hydrocarbons is, however, carbon in a very pure form; and, on account of its density, it is largely used for electrical purposes.

Next to oxygen, carbon is perhaps the most widely distributed of the elements. It occurs in the free state as the diamond and graphite—substances which, although physically dissimilar, can be proved to be chemically identical; the dissimilarity of the physical properties being perhaps due to some difference in the atomic arrangement. When an element occurs in forms which are physically dissimilar but chemically identical, the substances are called "allotropic modifications;" and the diamond and graphite are said to be "allotropic modifications" of the element carbon. The diamond occurs in well-defined crystals, and has a specific gravity of 3·5. It is one of the hardest substances known, and is used for cutting glass and polishing other precious stones. Graphite, on the other hand, is so soft that, when it is

drawn across a piece of paper, some of it rubs off, and leaves a mark; and on this account it is used as the core of lead pencils. It has a specific gravity of 2·2; and, unlike the diamond, it is a good conductor of electricity.

Charcoal and coke, obtained by heating organic substances out of contact with air, are often included as allotropic modifications of carbon; but they are not pure carbon, as they always contain oxygen, hydrogen, nitrogen, and any mineral constituents which may have been present in the original substance. Bone black, or animal charcoal, is a porous mass of calcic phosphate and carbonate, containing carbon in a fine state of division; while lamp black is finely-divided carbon, and generally contains some oily matter and hydrogen.

The porous forms of carbon possess a wonderful power of absorbing gases, of oxidizing easily-decomposed organic matter and gases, and of decolorizing solutions. This absorbent power varies (1) with the nature of the charcoal, and (2) with the temperature. Charcoal made from hard forms of woody fibre, such as the shell of the cocoa-nut, have the greatest absorptive power; while the lower the temperature, the more gas will be absorbed. This power of absorption varies with different gases. At ordinary temperatures, a cubic inch of freshly-prepared cocoa-nut charcoal will absorb 170 cubic inches of ammonia gas, but only 17 cubic inches of oxygen. The oxygen absorbed by fresh charcoal is in a highly-active condition; and, for a certain space of time, it can be utilized for the destruction of oxidizable gases. After being kept for a long time, however, the oxygen, by contact with the carbon, gradually becomes converted into carbon dioxide. Finely-powdered charcoal sprinkled over decomposing animal matter absorbs the gases evolved, and oxidizes them by virtue of the condensed oxygen in its pores. For this reason it is largely used for making sewer traps, as well as in respirators.

One volume of charcoal at 0° C. and 760 mm. absorbs—

	Volumes.
Ammonia	171·7
Cyanogen	107·5
Nitrogen dioxide	86·3
Ethylene	74·7
Nitrogen monoxide	70·5
Phosphoretted hydrogen	69·1
Carbon dioxide	67·7
Carbon monoxide	21·2
Oxygen	17·9
Nitrogen	15·2
Hydrogen	4·4

Carbon is insoluble, infusible, and non-volatile at ordinary temperatures; but signs of volatilization are apparent in the electric arc. The diamond does not easily conduct heat or electricity; but the other forms of carbon are conductors.

The liquid products of the destructive distillation of coal are tar and ammoniacal liquor. Tar derived from ordinary bituminous coal is a black, somewhat viscid liquid, varying in specific gravity from 1·1 to 1·2. London tar, made from coal with an admixture of only about 2 per cent. of cannel, has usually a specific gravity of 1·2; while provincial tar, made from coal with a larger proportion of cannel, is reduced to near the lower limit, owing to the greater quantity of light oils yielded by cannel. The ultimate composition of a London tar is approximately as follows:—

	Per Cent.
Carbon	77·53
Hydrogen	6·33
Nitrogen	1·03
Sulphur	0·61
Oxygen	14·50
	100·00

These elements in tar are built up into about 140 different compounds, traces of which can be identified; but for all practical purposes we may take the following as being the chief constituents:—

	Neutral Hydrocarbons.	Boiling-Point. Deg. Fahr.	Formulæ.	Sp. Gr.
Liquid	Benzene	176	C_6H_6	0·88
	Toluene	230	C_7H_8	0·87
	Xylene	284	C_8H_{10}	0·87
	Isocumene	338	C_9H_{12}	0·85
Solid	Naphthalene	428	$C_{10}H_8$	—
	Anthracene	680	$C_{14}H_{10}$	—
	Chrysene	—	$C_{18}H_{12}$	—
	Pyrene	—	$C_{16}H_{10}$	—
	Alkaline Products.			
	Ammonia	—	NH_3	—
	Aniline	380	C_6H_7N	1·02
	Picoline	271	C_6H_7N	0·96
	Quinoline	462	C_9H_7N	1·08
	Pyridine	240	C_5H_5N	—
	Acids.			
	Carbolic acid	370	C_6H_6O	1·07
	Cresylic ,,	397	C_7H_8O	—
	Rosolic ,,	—	$C_{19}H_{14}O_3$	—
	Brunolic ,,	—	—	—
	Acetic ,,	243	$C_2H_4O_2$	1·06
	Free carbon.			

In roughly considering the proportions in which the main constituents occur in coal tar, we can still further simplify the composition, and look upon it as containing benzol, naphtha, naphthalene, anthracene, carbolic acid, and pitch; and if this tar be carefully re-distilled, we find it can be separated into the constituents which distil over at various temperatures. First, light oils pass over, from which benzol and its homologues can be obtained; then heavy tar oil, from which carbolic acid is made; and pitch is left, from which a substance called anthracene can be separated. The benzol or benzene obtained is the source from which aniline is prepared; and it is from aniline that most of the coal-tar colours are derived.

When benzol is acted upon with fuming nitric acid, nitrobenzol is formed. On treating this with dilute sulphuric acid and zinc dust, or acetic acid and iron filings, hydrogen is evolved, and in its nascent state attacks the nitrobenzol and removes its oxygen—leaving behind the compound of carbon, hydrogen, and nitrogen called aniline. It is from aniline that the brilliant colours mauve, magenta, and other purples and reds, are produced by acting upon it with oxidizing agents; and from it can also be obtained the beautiful series of aniline yellows, blues, and violet.

The naphthalene used in the albo-carbon system of enriching gas is prepared from coal tar, which is distilled; the first portions consisting of naphthas, &c., while the second portion is rich in phenols and cresols. The second distillate is again distilled; and the residue left becomes semi-solid, owing to the separation of naphthalene, which on standing collects and cakes on the top of the oil. This is then removed, and pressed by hydraulic power in a hot press, each plate of which contains a steam-pipe to heat it. The crude naphthalene so obtained is then distilled; but it still contains a number of impurities, which would cause it to turn yellow. To get rid of these, it is melted, and forced by steam pressure into a steam-jacketed cylinder, where it is washed in dilute alkali, to get rid of the phenol, and four times with strong sulphuric acid, to remove sulphonates, meta-naphthalene, &c. It is then water-washed free from acid. These washings take about 72 hours. The naphthalene now undergoes a final distillation, after which it is melted in steam-jacketed coppers, and is ladled out and cast into sticks in an apparatus of the same construction as the old-fashioned candle-machines; these sticks being afterwards cut into the smaller pieces used in the lamp reservoirs.

The second liquid product of the destructive distillation of coal is the ammoniacal or gas liquor, which consists of water partly condensed from the hot gas, and partly added to wash the gas in the scrubbers. It contains, as its principal constituents, ammonia, partly combined with carbonic acid and sulphuretted hydrogen to form compounds which are decomposed on boiling, with evolution of ammonia gas, and partly combined with stronger acids to form compounds which require to be acted upon by a strong alkali before the ammonia contained in them can be liberated. The ammonia in the first class of compounds is technically spoken of as "free;" that present in the latter as "fixed." The following analysis will give an idea of the relative quantities in which these compounds exist in the liquor:—

		Grammes per Litre.
Free.	Ammonic sulphide	3·03
	Ammonic carbonate	39·16
Fixed.	Ammonic chloride	14·23
	Ammonic thiocyanate	1·80
	Ammonic sulphate	0·19
	Ammonic thiosulphate	2·80
	Ammonic ferrocyanide	0·41

From a scientific point of view, the term "free" is absolutely incorrect; and, in using it, the fact must be clearly borne in mind that in this case it merely stands for ammonia which can be liberated on simply boiling the liquor.

Ammonia gas, which forms the basis of these compounds, is readily prepared by mixing together powdered chloride of ammonium and quicklime. On heating the mixture, ammonia gas is given off, and calcic chloride and water are formed:—

Ammonic Chloride. Quicklime. Calcic Chloride. Water. Ammonia.

$$2(NH_4Cl) + CaO = CaCl_2 + H_2O + 2(NH_3)$$

Ammonia gas so prepared cannot be collected over water, on account of its great solubility; water dissolving 1149 times its own volume of the gas at normal temperature and pressure. It is best collected over mercury; but, being much lighter than air, it can also be collected by upward displacement, in the same way as hydrogen.

Ammonia gas is readily recognized by its pungent odour and strong alkaline reaction—turning yellow turmeric paper brown, and red litmus paper blue. The test-papers which have been acted upon, however, soon regain their original colour when exposed to the air, as the ammonia rapidly volatilizes; hence it is sometimes called a "volatile alkali." The gas does not support combustion; nor does it burn, in the ordinary sense of the word. If, however, it be ignited in oxygen, it readily burns with a non-luminous flame—forming water and liberating nitrogen. A mixture of ammonia and oxygen will explode when a light is applied to it; the products of the explosion being also nitrogen and water—

Ammonia. Oxygen. Nitrogen. Water.

$$4(NH_3) + 3O_2 = 2N_2 + 6(H_2O)$$

When ammonia gas comes in contact with hydrochloric acid gas, dense white fumes of ammonic chloride are formed. Ammonia gas can be liquefied by a pressure of about seven atmospheres; and this liquid, if cooled below −75°, freezes to a transparent solid.

The ease with which ammonia can be liquefied, the great cold produced when it again assumes the gaseous state, and the amount of gas dissolved by water, render it eminently adapted for use in freezing-machines, one of the best known of which is Carre's ice-making apparatus, in which ammonia evolved by boiling a strong solution of the gas is condensed by pressure

an iron reservoir, in the centre of which is a chamber to receive the substances to be frozen. The pressure is then taken off the reservoir; and the liquid ammonia once more rapidly assumes the gaseous state—producing so intense a cold that water, &c., placed in the chamber is frozen. The escaping gas is once more absorbed in cooled water, and can be utilized again and again.

If ammonia gas be sent through a red-hot tube, or if electric sparks be passed through it for some time, its volume is doubled, and on analysis is found to consist of a mixture of one volume of nitrogen and three volumes of hydrogen; hence the formula NH_3 is given to the gas. At normal temperature and pressure, 22·32 litres of the gas are found to weigh 17 grammes; hence its density, as compared with hydrogen, is $17 \div 2$, or 8·5.

It might be imagined, from the enormous solubility of ammonia in water, that the coal gas could easily be freed from this compound by the merest contact with wash-water. But in all purification it must be borne in mind that dilution of the gas to be absorbed by the presence of many hundred times its volume of other gases renders this far from easy; and if air containing 5 per cent. of ammonia be bubbled through water, or even strong acid, plenty will be found in the mixture after treatment, whereas, if pure ammonia gas had been used, not a trace would have come through.

The gas liquor produced is almost always employed in the manufacture of sulphate of ammonia, by a process of great simplicity. The free ammonia is first expelled by means of steam; and when this operation is effected, the liquor is treated with lime and more steam, in order to expel the ammonia. The ammonia and other gases are passed through strong sulphuric acid in lead tanks; and the crystals of sulphate of ammonia there forming are withdrawn from time to time by perforated copper ladles. The process is a continuous one—the stream of gas liquor flowing through the apparatus in one direction, while steam passes in the contrary direction.

The third class of products resulting from the distillation of coal consists of the crude coal gas, which contains, besides the gases enumerated in the last lecture, ammonia, carbon dioxide, sulphuretted hydrogen, and certain other volatile sulphur compounds, of which bisulphide of carbon is the most important, and which will be fully considered under the head of "Purification." The proportion in which the products are approximately obtained from a ton of gas coal is as follows:—

10,000 cubic feet of gas	=	380 lbs.	=	17·0 per cent.
10 gallons of tar	=	115 ,,	=	5·1 ,,
Gas liquor*	=	177 ,,	=	7·9 ,,
Coke	=	1568 ,,	=	70·0 ,,
		2240		100·0

* Liquor condensed from gas alone, without wash-water.

Having now glanced generally at the products of the destructive distillation of coal, let us attempt to gain an idea—necessarily very imperfect—of the changes which lead to their production, and the effect of temperature upon them.

If bituminous coal is distilled at a low temperature, the tar is found to contain considerable quantities of light paraffin oils; and there is no doubt that paraffin hydrocarbons are present in the original coal. These paraffins, under the influence of heat, split up into simpler members of the same series and into olefines; and if we imagine the action in its simplest form, we should have the gases as they were evolved consisting of (say) ethane and ethylene. These have now to pass down the heated retort on their way to the ascension-pipe; and the contact with the heated sides of the retort, and the baking from the radiant heat in the retort, set up an infinity of changes.

Ethane, when heated to this degree, splits up into ethylene and hydrogen; while ethylene decomposes to methane and acetylene, and the acetylene at once polymerizes to benzene, styrolene, retene, &c. A portion also condenses, and, at the same time losing some hydrogen, becomes naphthalene; and the compounds so formed by interactions among themselves build up the remainder of the hydrocarbons present in the coal tar, while the organic substances containing oxygen in the coal break down, and cause the formation of the phenols in the tar.

There is very little doubt that the general course of the decompositions follow these lines; but any such simple explanation of the actions taking place is rendered impossible by the fact that, instead of the breaking down of the hydrocarbons being completed in the coal, and only secondary reactions taking place in the retort, in practice the hydrocarbons to a great extent leave the coal as the vapours of condensable hydrocarbons, and that the breaking down of these to such simple gaseous compounds as ethylene is proceeding in the retort at the same time as the breaking up of the ethylene already formed into acetylene and methane, and the polymerization of the former into higher compounds. Starting with a solid hydrocarbon of definite composition, it would be theoretically possible to entirely decompose it into carbon, ethylene, methane, and hydrogen, and, by rapidly removing these from the heating zone before any secondary actions took place, prevent formation of tar. But any such ideal is hopeless in practice, as the coal is not a definite compound, and it is impossible to subject it to a fixed temperature.

If the retorts are at a temperature of 1000° C. when the charge of coal is put in, the temperature of the distillation will vary from about 800° C. close to the walls to about 400° C. in the centre of the coal; and in the same way, in the space above the coal, the products which come in contact with the sides of the retort are heated to 1000° C., while the gas near the coal is probably only heated to 600° C. Hence we find that the tar is formed of two distinct sets of products—the first due to incomplete decomposition, and the second to secondary reactions due to the products of the decomposition being kept too long in the zone of heat.

Of the first class, the light paraffin oils and pitch may be taken as examples; while benzene naphthalene and retort carbon represent the second. The formation of the second class of bodies is a great loss to the gas manufacturer, as, with the exception of the trace of benzene carried by the gas as vapour, these products are not only useless in the gas, but one of them—naphthalene—is a serious trouble, as any trace carried forward by the gas condenses with sudden changes of temperature, and causes obstructions in the service-pipes; while their presence in the tar means the loss of a very large proportion of the illuminating constituents of the gas. Moreover, these secondary products cannot be successfully reduced, by further heating, to simpler hydrocarbons of any high illuminating value; while such bodies as naphthalene and anthracene have so great a stability that, when once formed, they resist any efforts to again decompose them by heat, short of the temperature which breaks them up into methane, carbon, and hydrogen.

The ammonia is derived from the nitrogen present in the coal combining with hydrogen during destructive distillation—the nitrogen becoming distributed among all three classes of products; and the following table will give an approximate idea of the proportions which go to each:—

	Per Cent.
Nitrogen as ammonia	14·50
,, as cyanogen	1·56
,, free in gas and combined in tar	35·26
,, remaining in coke	48·68
	100·00

The effect produced by alteration in the temperature of the retort upon the composition of both gas and tar is very marked. As the temperature is raised, the yield of gas from a given weight of coal increases; but with the increase of volume, there is a marked decrease in the illuminating value of the gas evolved. Mr. Lewis T. Wright found, in a series of experiments, that, when four portions of the same coal were distilled at temperatures ranging from a dull red heat to the highest temperature attainable in an iron retort, he obtained the following results as to yield and illuminating power:—

Temperature.	Cubic Ft. of Gas per Ton.	Illum. Power. Candles.	Total Candles per Ton.
(1) Dull red	8,250	20·5	33·950
(2) Hotter	9,693	17·8	34·510
(3) ,,	10,821	16·7	36·140
(4) Bright orange	12,006	15·6	37·460

Composition of the Gas.

	(1) Per Cent.	(2) Per Cent.	(4) Per Cent.
Hydrogen	38·09	43·77	48·02
Marsh gas	42·72	34·50	30·70
Olefines	7·55	5·83	4·51
Carbon monoxide	8·72	12·50	13·96
Nitrogen	2·92	3·40	2·81
	100·00	100·00	100·00

The gas analysis of No. 3 was lost; but the illuminating power shows that it was intermediate in composition between Nos. 2 and 4. From this it will be seen that, with the increase of temperature, the hydrocarbons—the olefines and marsh gas series—gradually break up; depositing carbon in the crown of the retort, and liberating hydrogen, the percentage of which steadily increases with the rise of temperature.

The tar formed is affected to an even greater extent than the gas by alterations in the temperature at which the destructive distillation takes place. The lower the temperature, the smaller will be the volume of gas produced, and the lighter the specific gravity of the tar; while with increase in temperature, the volume of gas rapidly rises, and so does the specific gravity of the tar. Working with a caking coal, Mr. Wright obtained the following results:—

Yield of Gas per Ton. Cub. Ft.	Specific Gravity of Tar.
6,600	1·086
7,200	1·120
8,900	1·140
10,162	1·154
11,700	1·206

Analysis of the tar showed that increase of the specific gravity was due to the increase in the quantity of pitch, which rose from 28·89 to 64·08 per cent. in the residuals; while the ammonia, naphtha, and light oils steadily fell in quantity—the creosote and anthracene oils doing the same, but to a smaller extent. Naphthalene also begins to show in quantity in the tar as soon as the yield of gas reaches 10,000 cubic feet per ton of coal carbonized.

The extent to which the secondary reactions affecting the composition of coal gas take place must, of course, depend to a large extent upon the amount of the heated surface to which they are exposed in the retort, and the rate at which the gas is being evolved. I attempted to gain an insight into the effect produced by the heated surface by decomposing Russian

"Solar Distillate" oil in retorts of varying size; and the results obtained are given in the following table:—

	(A.)	(B.)	(C.)
Size of retort.	1 ft. 10 in. by 4 in.	4 ft. 6 in. by 2 in.	3 ft. 6 in. by 9½ in.
Temperature.	900° C.	900° C.	900° C.
Cubic feet of gas per gallon	72	92	98
Percentage of tar	12·7	18·3	20·2
Illuminating Value of the Gas.			
In candle power per 5 cubic feet.	57·1	46·0	49·6
In candles per gallon of oil	822·2	846·4	972·1
In grains of sperm per gallon	98,668·8	101,568·0	116,659·2
Composition of the Gas.			
Unsaturated hydrocarbons	36·55	29·79	33·16
Saturated hydrocarbons	53·97	62·30	45·15
Hydrogen	11·86	4·79	19·65

In the first retort, A, the surface exposed to the gases after their formation was very small; while in B they were forced to come into contact with a proportionally large heated surface. In the third retort, C, not only were the gases exposed to a large heated surface, but the diameter of the retort forced them to undergo a baking action from radiant heat in their passage through its length; and this seemed to give the best results, as there was an increase not only in the total illuminating value, but also in the tar.

Distilling-Points of the Residues obtained from the Various Retorts, in Percentages of Original Residue.

	60° to 70°	70° to 80°	80° to 90°	90° to 100°	100° to 110°	110° to 120°	120° to 130°	130° to 140°	140° to 150°	150° to 160°	160° to 200°
A	..	..	..	..	1·6	5·0	6·6	8·3	6·6	5·0	11·6
B	..	..	..	6·0	4·0	2·5	2·5	2·5	4·0	1·0	4·5
C	5·0	8·4	7·8	2·2	8·1	3·5	3·3	15·8	6·3	4·2	4·0

In order to determine the proportion of saturated and unsaturated hydrocarbons present, the distillates below 100° C. were mixed together, and treated with diluted nitric acid—half acid to half water—keeping the temperature low until action ceased. This process converted the olefines into resinoid bodies, from which the paraffins and benzene separated. These were then drawn off, treated with the strongest nitric acid and strong sulphuric acid to convert the benzene into nitrobenzol, which was then well washed, dried, and distilled; the result being—

Olefines	70 per cent.
Benzene	19 ,,
Paraffins	11 ,,

The fractions distilling between 100° and 150° C. had a specific gravity of ·809, and gave—

Unsaturated hydrocarbons	19 per cent.
Saturated hydrocarbons	81 ,,

Those distilling at from 150° to 260° C. had a specific gravity of ·956, and gave—

Unsaturated hydrocarbons	20 per cent.
Saturated hydrocarbons	80 ,,

Those distilling at from 260° to 315° C. had a specific gravity of 1·002, and gave—

Unsaturated hydrocarbons	12 per cent.
Saturated hydrocarbons	88 ,,

These figures show that the higher the distilling-point and specific gravity of the fraction, the greater is the percentage of saturated hydrocarbons; while in the most volatile portion of the residue, the unsaturated hydrocarbons preponderate. During the fractional distillation of the tar, large quantities of naphthalene volatilized, and condensed in the neck of the retort.

Trade Catalogues.—We have received a copy of the new catalogue issued by Messrs. Richmond and Co., Limited, of London and Warrington. It is preceded by some remarks on "Gas as a Domestic Servant," by Mr. E. W. T. Richmond. ——Messrs. D. Bruce Peebles and Co., of the Tay Works, Bonnington, Edinburgh, have recently issued an altogether unique trade catalogue, consisting of a short history of Edinburgh, illustrated by a number of well-executed reproductions from photographs of the principal objects of interest in the city and neighbourhood. An account of the firm's works and their productions modestly occupies the last few pages; their specialities being fully described and illustrated on the wrapper and on leaflets inserted in the pamphlet.

A New Filling Material for Thermometers.—Quicksilver, with which thermometers are ordinarily filled, has the drawback that it freezes when the temperature sinks to 39° C. Alcohol, which is also used for the same purpose, frequently contains water, so that its registration can never be fully trusted. It has now been found that toluol, one of the products of the distillation of coal tar, is applicable as a filling. It contains absolutely no water, and does not easily evaporate; it can stand a much lower temperature than quicksilver without freezing; and, when exposed to warmth, extends with great regularity. Further, it is very cheap; and as it is much lighter than quicksilver, the tube of the thermometer can be made larger than is now usual; thus securing greater exactitude in the registrations. It is of a dark blue colour, which is easily distinguishable in the glass tube; so that the readings of the thermometer can be easily and quickly seen.

COAL IN COLOMBIA.

In the course of a report on the above subject, Mr. C. F. Z. Caracristi makes the following remarks:—

Looking at the map of Colombia, we see a great indenture on the Atlantic coast of the department of Cauca, formed by the Gulfo de Uraba, or Darian del Nord. Into this gulf flow the Atrato, Arboletes, Punta de Piedra, and many other small streams. I consider the territory embraced within latitude 7° 30′ and 9° north, and longitude 2° and 3° 15′, meridian of Bogota, as containing the most promising coal deposits of the Atlantic coast of South America. The coal measures expose themselves from Cabo Tiburon, on the borders of the department of Panama, and follow around the gulf and shore; traversing the various rivers, and entering into the department of Bolivar after coursing the Arboletes. From here the coal extends to the Rio Magdalena, following the geological base of the hills from the valley of the Atrato. On its way through the department of Bolivar, the coal is exposed when it crosses the Rio Sinu and Cannaletta.

The coal which I explored on the Uraba coast was, first, a large deposit which exposes itself about three miles from the mouth of the Rio Punta de Piedra. Here the inundations have washed a small cañon through which the river flows, and on the banks of which may be found carboniferous outcroppings. Secondly, a large and well-defined extension of the deposit of Rio Punta de Piedra on the right bank of the Rio Volcan at its confluence with Rio Arboletes, four miles from its point of emptying into the gulf. At this point the veins of coal are from 3 to 20 feet thick, and extend southward a distance of not less than 60 miles. Thirdly, I examined the coal of the Atrato; but, owing to the rise of that river, I was unable to learn, with any degree of precision, the nature or geological condition of the deposit. Fourthly, I discovered large veins of coal on the Rio Sinu, and excellent coal on the Rio Cannaletta.

In Cauca, there are upwards of 20 veins of coal—anthracite, bituminous, and lignite—all of which has more or less commercial value. In their whole distance along the Darian in Cauca and the shores of Bolivar to a point opposite Puerto de Colombia, the coal measures have a length of 260 miles with an average width of 30 miles. This gives a square mileage of 7800, or a coal area equal to that of Alabama. At a distance of about six miles from the Rio Caiman, in a northwardly direction, the carboniferous strata showed a "pinched" condition, and are somewhat distorted and irregular, doubtless from the effect of recent volcanic dislocations. The same may be said of the coal measures where they cross the Rio Varacuarando, above Turbo, to the south. On the Rio Arboletes and the Volcan, the "droppings" are even more wonderful than those of Pennsylvania, or, in fact, any I have had occasion to examine during my professional career of more than 13 years.

The following are the analyses of the coal of Uraba:—

Sample from Arboletes.	Per Cent.	*Sample from Punta de Piedra.*	Per Cent.
Sp. gr. 1·62.	—	Sp. gr. 1·81.	—
Fixed carbon	41·50	Fixed carbon	77·52
Ash	6·11	Ash	7·31
Volatile matter	50·33	Volatile matter	12·41
Water	2·06	Sulphur	0·26
		Water	2·50
Total	100·00	Total	100·00
Colour of ash, white alkaline; quality of coal, black lignite.		Colour of ash, yellow; quality of coal, anthracite.	
Coke	49·30	Heating power.	60·92

The coal follows the coast line at a distance of from three to forty miles. I would estimate the visible supply at not less than 18,459,200 tons in the department of Cauca and Bolivar alone. The cost of mining the coal I place at about $2·10, as against $1·62 in Pennsylvania.

At a distance of two miles south of Santa Maria, at the base of the mountains, I found the first coal cropping in the form of a vein of lignite, bearing with it cannel coal, which, upon development, I believe will be found to be a valuable deposit.

At Rio Fundacion, about 1½ miles above the abandoned village of the name, the coal measures assume a proper and healthy form, and exhibit large veins of coal for a distance of six or eight miles up the river. The total distance from Santa Maria to Rio Fundacion is some seventy miles, about sixty of which are on the coal measures. In the Val du Par, too, I discovered extensive beds of the best quality of cannel coal.

On the Petrale cañon and on Rio Fundacion, I entered into extensive excavations, which proved the coal to exist in well-defined veins, and the "hanging" and "foot" walls to be of healthy sandstone, which necessitated but little timbering in the working of the coal. These mines are extremely valuable, owing to the fact that they exist at a healthy elevation above the sea, are supplied with cold water from the glacier of Santa Maria, and are on navigable rivers and on the line of a railroad now under construction from the porte of Santa Maria. The analysis of the coal of this region speaks for itself: Fixed carbon, 34·85 per cent.; ash, 7·35 per cent.; volatile matter, 57·80 per cent. The coal will not coke; it gives a white ash, and is peculiar in the fact that it ignites under a heat of 270° Fahr. The carboniferous measures of this region extend along the coast of Venezuela to the Lago de Maracaibo, where an English Company is opening up the mines.

GAS-BURNERS AND THE COMPARATIVE COST OF GAS AND ELECTRIC LIGHTING.

(*Concluded from p.* 240.)

The Comparative Cost of Lighting by Gas and Electric Light.

On April 8, 1892, Professor Ayrton gave a discourse at the Royal Institution on meters, motors, and money matters. He exhibited on that occasion several curves, showing the cost of lighting by different gas-burners. These curves, which have not before been published, are combined in a single diagram in fig. 9. The cost is based upon one candle power for a year, at four hours a day, and gas at 2s. 6d. per 1000 cubic feet. This comes to 1460 hours, and is equivalent to lighting from dusk until 10 p.m. The costs have been derived from the figures in the report prepared by Messrs. Haycraft, Weightman, and Gawthorp, already dealt with.

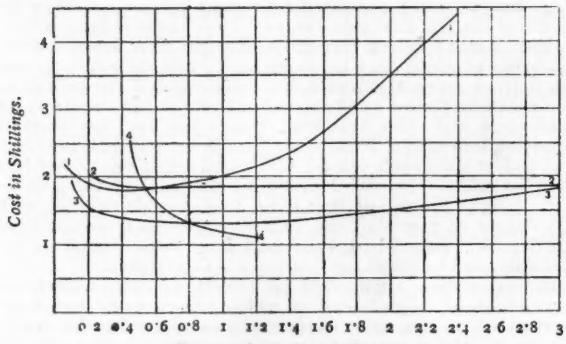


Fig. 9.—Pressure, and Cost in Shillings, per Candle per Year, burning Four Hours per Day, at 2s. 6d. per 1000 Cubic Feet.

1. Bray's No. 5 Enamel Reg. Un.-Jet.
2. „ Street-Lamp Burner, with Gov.
3. Sugg's No. 5 Table-Top, Governed.
4. „ No. 1 "London" Argand.

In attempting to draw a comparison between the cost of gas lighting and of electric lighting, we are met with two difficulties. The candle power per cubic foot of gas per hour, called the "efficiency" in the report, depends largely on the size of the burner. Small gas-burners give a very poor result. No such difference exists with glow lamps. It is true that the 8-candle 100-volt lamp of the Edison and Swan United Company took about 5 watts per candle, and that we are now hoping to find 2½-watt lamps, or at all events lamps taking a mean of about 3 watts per candle throughout their lives. But, speaking generally, the efficiency of a glow lamp has little to do with its candle power, as with gas-burners. On the other hand, a good gas-burner supplied with decent gas, and not exposed to dirt and weather, has a long life; and the candle power remains practically unaltered. It is true that gas-burners often become choked with dirt and rust—greatly reducing the light; but this cannot be fairly attributed to any defect in the burner. A glow lamp suffers from such a defect. Its life is short and uncertain; more figures must be based upon its average performance; and the cost of renewals must be added to the cost of electrical supply.

While for purposes of strict comparison we ought to consider the mean performance, it must be admitted that, in a large majority of cases, the consumption of current per lamp is of more importance to the consumer than the watts per candle power. We could at one time get no 100-volt lamp that took less than an average of 30 to 40 watts throughout its life; and now we can buy lamps starting at 20 watts. A 4-candle 100-volt lamp, taking (say) 12 volts to start with, would be a great boon to consumers, and would not, we believe, entail a loss of revenue to supply companies. A small gas-burner, however, is a distinctly wasteful affair, as is clear from curve 7 in fig. 3, and curves 7 and 8 in fig. 5. And it must be remembered that the Welsbach burner has a short life and a quickly falling candle power, and that the mantle is extremely fragile.

After these preliminary remarks, we may proceed to Professor Ayrton's curves. Four different burners were selected; and the chief feature of the accompanying diagram (fig. 9) is the quality of the regulation. The Bray street burner regulates perfectly between 0·6 inch and 3 inches pressure. This is very interesting; but it must be remembered that gas companies, with all their failings, do not force their gas through the consumers' pipes at a 3-inch pressure. For practical purposes, pressures from 0·6 inch to 1·5 inches only need be considered. We have no hesitation in disregarding at once the Argand burner; it is as outside the present comparison as an arc lamp. We assume 1s. 10d. as the average cost. We do not, however, take this figure from the curves in fig. 9.

The last tables of the report on "Tests of Gas-Burners" consisted of the cost of one candle-hour at the maximum observed candle power with different burners; gas being taken at 2s. 6d. per 1000 cubic feet, and the cost of one candle-hour under the conditions of maximum efficiency. Omitting the last six burners, which are of large candle power and high efficiency, the average of the remaining 22 is 0·0187d. for the maximum candle power, and 0·9156d. for the maximum efficiency. The maximum candle power necessitated in most cases a high pressure of gas. We therefore take the mean candle power at the maximum efficiency at whatever pressure that efficiency may be obtained. A cost of 0·0156d. an hour for 1460 hours (Professor Ayrton's unit) comes to 22·8d., or (say) 1s. 11d.

Before proceeding farther, it may be remarked that the cost of electrical supply for glow lamps at 2½ watts per candle, and at 6d. per supply unit, is exactly the same as this average—viz., 1s. 10d. for 1460 candle-hours. To this lamp renewals must be added. Lamp renewals at 1s. 6d. per lamp, and a life of 400 hours, come to about 5s. 6d. for 1460 hours, or 7s. 4d. for a life of 300 hours. In the absence of any definite information, we will assume a life entailing a cost of 6s. for renewals during the year. But as 8-candle lamps cost no less than 16-candle lamps, and may be assumed to have the same life, the cost of lamp renewals for the former lamps is twice that of the latter lamps per candle-hour or candle-year. The cost for 1460 candle-hours would be as follows:—

	2·5 Watts per Candle Power.	3 Watts per Candle Power.	4 Watts per Candle Power
1 c.p. without renewals. . .	21·9d. ..	26·28d. ..	35·04d.
8 c.p. with renewals. . . .	30·9 ..	35·28 ..	44·04
16 c.p. „ „	26·4 ..	30·78 ..	39·54

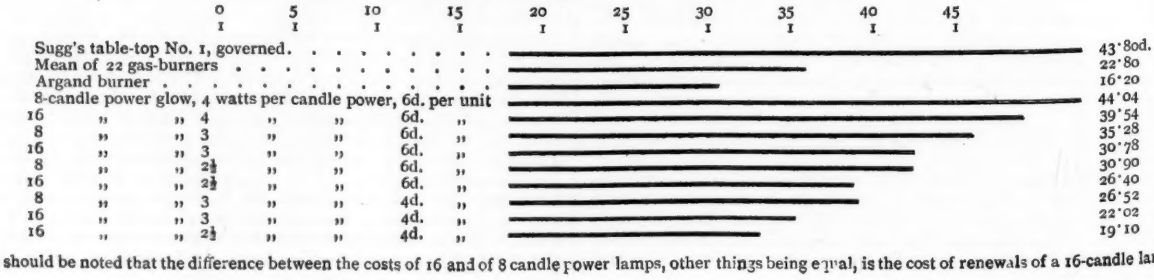
From these examples we must for the present discard the 2·5 watts per candle. It is true that we have promises, and indeed offers, of such lamps, and a guarantee of one at 2s.; but we have no experience as to their life. We take, then, 3s. as a fair average; and against this we put the 1s. 10d., the average cost of gas lighting. The cost of electric light by glow lamps at 6d. per unit is, then, to the cost of gas lighting at 2s. 6d. per thousand as 100 : 61. The two costs would be almost identical if the price of gas were 4s. per 1000 cubic feet. The old rule used to be to multiply the price per unit of electrical supply by 10 to obtain the equivalent price of gas per 1000 cubic feet. It appears that at 3 watts per candle, and lamp renewals at the rate we have assumed, the factor 8 instead of 10 may be used.

We have assumed that the cost of renewals will be 6s. for 1460 hours, irrespective of the watts per candle at which the lamps are run. The renewals will, of course, be much lighter for lamps at 4 watts than 2½ watts per candle—say, 3½ to 4 times less; but we have no data to go upon at present. This will tend to equalize the cost of electric lighting; but as we have taken such short lives as from 300 to 400 hours, the result will be to reduce the cost of the lighting at 4 watts per candle, and probably not to increase even the lighting at 2½ watts to any appreciable extent. It appears that, in order to compete with the average gas-burner with gas at 2s. 6d. per 1000 cubic feet, a 16-candle lamp must be run at nearly 2½ watts per candle, and at the rate of 5d. per unit for electrical supply.

The following table shows at a glance the comparative magnitudes of the foregoing costs. We are indebted to Messrs. R. J. Wood and H. C. Leake, of the Central Institution, for confirming our numerical calculations.

Comparison of Costs of Lighting.

Scale: One centimetre equals 5d. per candle per year, four hours per day.


0 5 10 15 20 25 30 35 40 45
Sugg's table-top No. 1, governed. . . . . 43·80d.
Mean of 22 gas-burners . . . . . 22·80
Argand burner . . . . . 16·20
8-candle power glow, 4 watts per candle power, 6d. per unit 44·04
16 „ „ 4 „ „ 6d. „ 39·54
8 „ „ 3 „ „ 6d. „ 35·28
16 „ „ 3 „ „ 6d. „ 30·78
8 „ „ 2½ „ „ 6d. „ 30·90
16 „ „ 2½ „ „ 6d. „ 26·40
8 „ „ 3 „ „ 4d. „ 26·52
16 „ „ 3 „ „ 4d. „ 22·02
16 „ „ 2½ „ „ 4d. „ 19·10

It should be noted that the difference between the costs of 16 and of 8 candle power lamps, other things being equal, is the cost of renewals of a 16-candle lamp.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Thursday, Feb. 8.

(*Before Lords Justices* LINDLEY, KAY, *and* SMITH)

Green and Haydon v. The Chelsea Water-Works Company.

This was an appeal by the plaintiffs from the judgment of Mr. Justice Mathew, delivered on the 20th of December last; the action having been heard by his Lordship, sitting with a special jury, in the previous month.* It was brought by the plaintiffs, who are livery-stable keepers at No. 141, Upper Richmond Road, Putney, to recover damages sustained by them through the bursting of one of the defendants' water-mains in the Putney Hill Road. The claim was based on the alleged negligence of the defendants' servants, and on the main not having been properly and skilfully laid and kept in repair. The jury found in favour of the defendants as to negligence; and the case was afterwards argued before his Lordship on the point of law, whether defendants were, under the circumstances, insurers. His Lordship decided in favour of the Company, and hence the present appeal.

Mr. H. KISCH appeared for the appellants; Sir R. E. WEBSTER, Q.C., M.P., Mr. MOULTON, Q.C., and Mr. ENGLISH HARRISON represented the respondents.

Mr. KISCH contended that defendants were liable on the principle laid down in *Fletcher v. Rylands*.

Counsel for the respondents were not called upon.

Lord Justice LINDLEY, in giving judgment, said he was of opinion that this was an experiment which ought not to succeed. The case of *Fletcher v. Rylands*, on which the appellants relied, had nothing to do with companies authorized by Act of Parliament; it was merely the case of an ordinary landowner, who, for purposes of his own, had stored up water to such an extent that it became dangerous. In the case of *Dunn v. The Birmingham Canal Company*, the Court held that the plaintiffs, who had constructed a canal under the authority of an Act of Parliament, were not liable for injury caused by water which escaped from the canal into a mine. If a company were authorized to do what they were doing, and there was no negligence, there was no breach of duty cast on them by *Fletcher v. Rylands*, or the statute under which they were acting.

Lord Justice KAY said the jury had found that the accident happened through the bursting of certain water-pipes, by reason of which the plaintiffs had been damnified, and in respect of which they sought to make the defendants liable. The pipes were put down by a public Water Company, who had power to lay them down by their Private Act. That Act incorporated the Water-Works Clauses Act and the Lands Clauses Consolidation Act, and empowered them to take compulsorily so much of the soil as was necessary for the purpose of laying their pipes in the soil of other people within the limits of deviation indicated by the Act. They had done this under the powers of their Act. When attacked by some one who had been injured by an escape of water from the main, they referred to their Act, and said: "If we, as private owners of land, had laid down water-pipes in land of our own, for our own purposes, we might be liable to you under the doctrine contained in *Fletcher v. Rylands*; but we are a public body, authorized to do this by Act of Parliament for public purposes, and for the benefit of the neighbourhood in which it is done." The defence really amounted to this: Having been authorized to do what we have done by Act of Parliament, you cannot claim as against us to be recompensed for damage you have suffered, unless you can show that the damage was occasioned by negligence on our part. This was the law; and there were a large number of cases exemplifying it.

Lord Justice SMITH gave judgment to the same effect.

The appeal was therefore dismissed, with costs.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, Feb. 7.

(*Before Mr. Justice* WRIGHT.)

In re the Buckfastleigh Gas Company, Limited.

Mr. G. HENDERSON appeared to-day in support of a petition presented by Mr. F. Bradley for the compulsory winding up of this Company, which was formed in May, 1893, with a capital of £9000. He said his client was a judgment creditor for £70 and costs upon a dishonoured bill of exchange; and the petition was supported by a creditor for £56 in respect of printing. The assets of the Company consisted of about £300 due from customers in respect of gas supplied, and £1200 of uncalled capital.

No Counsel appearing to oppose on behalf of the Company,

His LORDSHIP made the usual order for compulsory winding up.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Tuesday, Feb. 6.

(*Before Mr. Justice* WRIGHT.)

The Gas Lighting Improvement Company, Limited, v. The Tottenham and Edmonton Gaslight and Coke Company.

This was an action to recover damages for alleged breach of contract. Under letters dated April, May, and June, 1892, the defendants purchased of the plaintiffs, by contract, a carburettor, steam-pump, store-tank, &c., at a given price, with 15 per cent. discount. One of the conditions contained in the contract was in the following terms: "We are allowing you this discount on the understanding that you take the enriching material used from us at the lowest market price—that is, if you can buy it cheaper elsewhere, you are at liberty to do so; but should other people's prices be the same as ours, you give us the preference of supplying you." The case for the plaintiffs was that the defendants had broken this contract, inasmuch as between the supply of the carburettor and August, 1893, they purchased and took the enriching material from other persons, at the same or at higher prices than those for which the plaintiffs were willing to sell it. Defendants had further, it was alleged, accepted a contract for the material for one year ending August, 1894, of other persons, at a figure at which the plaintiffs would have supplied it, and without giving the plaintiffs the preference; and they claimed damages. Defendants traversed the plaintiffs' claim, and said that, if they had entered into the contract alleged (which they did not admit), they did so because they could buy the enriching material elsewhere at a lower price than that charged by the plaintiffs.

Mr. BIGHAM, Q.C., and Mr. J. E. BANKES appeared for the plaintiffs; Mr. FINLAY, Q.C., and Mr. DANCKWERTS, for the defendants.

The figures were not disputed; and the evidence in the case turned on the testimony of Mr. Tennant and Mr. Broadberry, the Managers for the respective parties, together with that of Mr. Leonard, a member of the firm of Messrs. Carless, Capel, and Leonard, who, the plaintiffs asserted, had supplanted them in the supply of carburine to the defendants. The plaintiffs charged 9¼d. per gallon for this enriching material; and though defendants, the plaintiffs said, never complained to them of this price, they obtained supplies from Messrs. Carless, Capel, and Leonard at 8¼d., without giving plaintiffs the option, which they claimed had been granted to them under the contract, of supplying defendants at the same price as was charged by others. In February last, when defendants sent out invitations for tenders for the supply of the material for twelve months, plaintiffs offered to make their price 8¼d.; and they added to this a reminder to defendants that "we have an option of selling to you at a lower price." As defendants took no notice of this hint, plaintiffs interpreted it as acquiescing in their view of the relations subsisting between the parties on which plaintiffs' action was based. It seemed that, on the same day that Messrs. Carless, Capel, and Leonard tendered to supply defendants at 8d., plaintiffs offered at 8¼d. But Mr. Tennant asserted that, on going to see Mr. Broadberry on the subject, he told him he was too late—that the contract had been placed elsewhere—and that had he tendered at 8d. he would have secured it. Mr. Broadberry, however, said that he neither made the last remark nor was he authorized to make it; and he should not have thought it a businesslike, or, if businesslike, not an honourable proceeding to obtain an offer from one firm in order to beat down the price of another. Consequently, he thought he could not have made the remark. Mr. Leonard explained the circumstances under which his firm tendered; and said that there was a delay of some months. On seeing Mr. Broadberry, he (witness) was told the matter would be settled in a day or two. They obtained the order at 8d. Mr. Tennant was formally asked if plaintiffs could have supplied the material at a profit at the price they quoted; and he replied in the affirmative.

Mr. FINLAY submitted that plaintiffs had not made out any case.

Justice WRIGHT, in giving judgment, expressed the opinion that, on the whole, the plaintiffs' case had failed, even supposing that the contract was not in itself void for uncertainty. There was nothing in it to indicate how long the supply was to go on—apparently to the end of time. But, assuming the contract to be good, while he was satisfied that both Mr. Tennant and Mr. Broadberry gave an accurate version of what they believed took place, he must notice the variation between them; and he was not at all satisfied that Mr. Tennant's version was not slightly the less probable. It was said that the contract prevented the defendants from making one for their supply in the ordinary way, by calling for tenders; but he found nothing in the contract to prevent that. They were bound to ask the plaintiffs at what price they would supply the material. He could not think, however, that they had to do anything more; and it was obvious that if it were known that tenders were invited merely for the sake of arriving at a price below what another firm would supply at, no one would tender, and the defendants would be at the mercy of the plaintiffs. He saw nothing unreasonable in what the defendants had done. Neither party had acted in bad faith, so far as he could see. He was not able to read into the contract any such obligation as he was asked to place upon it; and his judgment would therefore be for the defendants, with costs.

East London Water Company.—The shareholders of this Company, at a meeting held last Thursday, formally approved of the Bill promoted by the Directors for the purpose of enabling them to raise additional money to fulfil their statutory obligations relating to the supply of water, and to meet the increased demand for water within their parliamentary district.

Indignant Gas Consumers at Holyhead.—The action of the Holyhead Gas Company in deciding to supply gas for cooking purposes, at a considerable reduction, is calling forth some strong comments. The former charge was 4s. 9d. per 1000 cubic feet; and this is now reduced to 3s. 10d. Those who consume gas for lighting purposes, on the other hand, have recently had the price raised from 4s. 9d. to 5s. per 1000 feet. The reason assigned for the latter change is not deemed satisfactory; and much indignation is consequently felt by consumers affected. It is stated that a strong protest is likely to be lodged by the Holyhead Local Board and the London and North-Western Railway Company, who have been charged the increased rate, and are the largest consumers in the borough.

The Kendal Corporation and the Gas and Water Works.—The vote of the ratepayers of Kendal on the proposal of the Corporation to acquire the undertaking of the Kendal Union Gas and Water Company was taken last week. The Corporation have agreed to give £80,000 for the undertaking; and they propose to spend a further sum of £24,000 on additional works of water supply. At a meeting of the ratepayers, an adverse vote was recorded; but this decision has been reversed on the poll. The actual voting was: For the purchase, 1997; against it, 867—majority, 1130. It appears that, of the respective totals, 453 property owners voted for the purchase, and 154 against it. The total number of voting-papers issued was 2781; and 765 of them were not filled up, or were for other reasons not included in those counted.

* See JOURNAL, Vol. LXII., pp. 1088, 1173.

MISCELLANEOUS NEWS.

THE GASLIGHT AND COKE COMPANY.

The Half-Yearly Ordinary General Meeting of this Company was held last Friday, at the Chief Office, Horseferry Road, Westminster—Colonel W. T. MAKINS (the Governor) in the chair.

The SECRETARY and GENERAL MANAGER (Mr. J. W. Field) having read the notice calling the meeting, the report of the Directors and the statement of accounts, the principal portions of which were published in the JOURNAL last week, were taken as read.

The GOVERNOR, in moving the adoption of the report and accounts, said he thought the proprietors would agree with him that, on the whole, the report on the present occasion was satisfactory. They had passed through a very anxious and trying half year, for many reasons; but he thought that, altogether, they might congratulate themselves on the result of the working. The expenditure on capital account during the six months had been £77,737, of which £31,700 had been spent on the pier and on the hydraulic machinery at Beckton (which would enable them to handle their coal with much greater ease and at a lower cost), and £30,100 had been laid out in other ways at the same station. At Bow Common, they had spent £10,000, chiefly on the new retort-house, which they were putting up for the purpose of making an experiment of their own, on a working scale, in the use of inclined retorts. There was no doubt that this retort-house would be ready for the coming season. They had also expended £5200 on small matters at various other stations. He was happy to tell the shareholders that very little more capital would be required to complete the works in hand—some £88,000; and he hoped it would not be necessary to call up any more money for some time to come. They were in a very strong position now. They could easily give a maximum day's supply of 150 million cubic feet of gas; whereas two winters ago their maximum daily supply was 128 millions. Owing, however, to the extraordinary weather of the present winter, their maximum day's supply—it was one day last month—had been only 105 million cubic feet. The salient point in the revenue account was the great loss in the gas sales; and, as stated in the report, this was accounted for almost entirely, if not entirely, by the phenomenal nature of the weather in the past half year. Often during the coal strike he was condoled with by friends on the trouble that it was giving the Company; but he was able to tell them that they were fortunate in not suffering from the coal strike, although they were from the fog strike. They had had neither frost, fog, nor very cold weather; and they had had to keep a large number of retorts ready to meet the requirements of weather which had not come. They must congratulate themselves upon this as human beings; but it was a very serious matter from a gas shareholder's point of view. In the first place, they had made a large capital expenditure to meet the requirements of an ordinary winter. In the next place, the fixed charges of the Company were the same, whether they sold a large or a small quantity of gas; and the universal bugbear of the parish rates also remained the same. Possibly, it would astonish some persons to hear that the average temperature in the December half of 1893 was 2½° higher every day than it was in the corresponding period of 1892. Not only had it been a much higher temperature day and night all through the half year, but there had been a most extraordinary increase in the hours of sunshine—amounting to no less than 22 per cent. In these circumstances, it was not at all surprising that their consumption had fallen off so heavily; and it was very curious that the reduction in the consumption varied almost exactly in inverse ratio to the increase in temperature and to the increase in sunlight. Some people might imagine that sunshine and warm weather were not their only enemies. They might say: "You have also had to contend with the electric light, which probably accounts for a good deal of your reduction." Well, he might have been inclined to think so himself, but for the fact that in their district on the south side of the river (where there was little or no electric light, and where the price corresponded with that charged by their neighbours) the reduction in consumption had been about the same—viz., 5 per cent. The fact, therefore, was that the diminution in the consumption of gas was entirely attributable to the weather. He might make this a little clearer. The decrease over the whole of their district, north and south, had been 5½ per cent.; and the decrease over the portion adjoining the South Metropolitan Company's district, where their price was the same, was 5 per cent.

Mr. SNOWDEN inquired whether the price in the district mentioned was the same as was charged by the South Metropolitan Company.

The GOVERNOR replied that, where they supplied gas on the south side of the river, they had, by Act of Parliament, to charge the same as the South Metropolitan Company. This was part of the Scheme of Amalgamation.

Mr. SNOWDEN remarked that he did not think that this point was generally known.

The GOVERNOR agreed with this view. Proceeding, he said he was indeed surprised to see the amount of ignorance displayed by the public in gas matters. From the public point of view, the diminution in the consumption had been very satisfactory, because the consumers had saved in their gas bills, in the half year alone, above £80,000. There was another feature which was also very satisfactory—that, in spite of the decrease in the consumption, there had been a large increase in the number of services laid, in the consumers, in meters, in the supplies to workmen's dwellings, and in gas-engines; and last, but not least, the stoves issued on hire and sold to consumers in the six months had increased by upwards of 9 per cent. Their business, therefore, was not in a very sickly condition. The rental of meters would indicate to the proprietors who had studied the accounts, that the business was increasing in that direction. The receipts for residual products had been pretty good—he might almost say, very good. Coke had yielded them 1s. 9d. per ton of coal more than in 1892; tar, the same; and ammoniacal liquor, nearly 4d. per ton more. In all, this improvement had equalled 1s. 5½d. per ton of coal; and, as far as the Directors could judge, the prospect was that the improvement would continue, and be fully maintained. There were some breaks in the "bad trade" cloud; and they thought they saw a little light on the horizon. The chemical and some other trades were not quite so stagnant as they had been. With respect to the cost of coal, including the expense of enrichment, it showed a saving of 1s. 8½d.; and this, considering the small reduction in the proportion of cannel used, had not been attended by any decrease in the quantity or quality of the gas made. This 1s. 8½d. added to the 1s. 5½d. gain from residuals gave them a total net reduction in the cost of coal of 3s. 1¾d. per ton as compared with 1892; and but for the serious increase in the price of coal as now quoted, the Directors would have been able to fulfil their desire of reducing the price of gas from Jan. 1 last. Everyone, however, would see that, in the present disturbed condition of the coal market, it would be very foolish for them to make any reduction yet; but they would look forward to it as something in the future. In an evening paper last week, and in *The Times* that morning, reference was made to "a little game" that was going on in the North for raising the price of coal against the gas companies. Having quoted from the newspapers in question, he said he only wished to state that any such combination to artificially increase the price of a raw material so universally used as coal was bound to end in failure. It had been tried before, in 1888; and the attempt failed. The truth was that these combinations never held water; there was always someone who would "turn tail"—someone who would break away. It was not in the nature of things that such a combination could succeed, because it was impossible that every coal owner could win his coal at the same price. Some must get theirs cheaper than others; and they would never get the man who had the advantage of cheap production to consent to keep himself out of the market, in order that another man who had to pay more for production should have a share of the plunder. But even if it should succeed, he did not think they need be unnecessarily alarmed. They had been making, during the past half year, some very large and important experiments in the direction of carburetted water gas. This kind of gas was very largely used—in fact, he believed almost entirely—all over the United States, where coal was much dearer and scarcer than it was here. This kind of gas also had some special advantages. In the first place, the plant for producing it was only half the cost of the plant for manufacturing coal gas. In the second place, it could be generated very rapidly, and could be used to meet a sudden demand; so that they had not to keep their plant and retorts always waiting in case they might be surprised by a sudden accession of cold or fog. In the third place—and this was most important—it required a good deal less labour. There was any amount of oil to be obtained; and, if it were required on a very extensive scale, greater facilities would be given for supplying it, and probably at a cheaper price. Therefore, if the gentlemen in the North were so ill-advised as to try and raise the price of a raw material which was so necessary for the well-being of the public as coal was, they must see whether they could not help themselves by turning to something else. He did not say this by any means as a threat; but he wished it to be known that they had two strings to their bow. Their wages had been higher per ton; they had been paying wages in anticipation of fog, coal, and frost which had not come. Before leaving the question of coal, he desired to say that their coal contractors had treated them exceedingly well, as far they could, during the strike, with one or two exceptions, and notably with one exception. One contractor thought it was quite the proper thing to sell the coal at a very enhanced price on account of the "squeeze." The view of that gentleman in the carrying out of a contract and their own view did not accord; and the probability was that he would not be in the list of tenderers again. Generally, however, they had had their deliveries pretty good; and where they had been very much behindhand, the delay had arisen, in great measure, not from the fault of the coalowners, but because the railway companies had not the trucks to carry the coal to the seaboard. The wear and tear included the final payment in the shape of special expenditure on gasholders and purifiers to which reference was made at the last meeting. The increase in rates was mainly due to the extra penny in the income-tax; and, in one or two cases, to a slight increase in the rate in the pound in the parish assessments. The parliamentary expenditure was incurred by the inquiry into the Canal Rates and Charges Bill, which affected very severely their supply of coal for their in-town stations. They were, however, successful in protecting themselves by this outlay. He had just spoken of the bugbear of the rates. They had now got pretty well to know what was the result of their fight with the Vestries on the late quinquennial assessment; and the net result of their action was that they had obtained a reduction of £50,700. This was equal to an annual saving in rates of £14,400, which, for the whole quinquennial period, meant £72,000. Unfortunately, they had had to spend somewhere about £24,000 to obtain this result. But, still, they stood with a net balance of more than £50,000 to the good; and they believed that, to a very great extent, they had settled the question as regarded future assessments. They could not tell what the parishes might have had to pay. But he had no doubt their bills were as large as, or larger than, the Company's; and the parishes would probably think twice before fighting them again. The incident in regard to the candles used in the testing of gas, referred to at the last half-yearly meeting, was now, he thought in a fair way of settlement. The London County Council had called upon the Referees under the Act to prescribe the candles to be used for testing the Company's gas. This was unquestionably one of the most difficult and delicate questions which the Referees had ever had submitted to them. The Directors had the fullest confidence, however, in their thorough integrity, their scientific attainments, and their perfect independence; and they did not look with any alarm on the result of the deliberations of these gentlemen on this point. The Referees had already issued a prescription with regard to the candles which were now being manufactured, and which would be submitted to very exhaustive tests in order to see that they complied in all respects with the statutory requirements. There was only one other point in regard to this matter to which he desired to refer. He alluded to some charge which had been made against the Gas Companies, and which had been already ably met by their friend Mr. George Livesey. The charge was that they were not supplying the gas which they were legally bound to supply—that they

were sending out an inferior quality; and it was suggested that, by means of a portable photometer, the gas should be tested without notice in any place. The objection to this portable photometer, in the first place, was that it was illegal; and, in the second place, that it was unfair to the Company. It was unfair in this way: They might take the portable photometer, and test the gas at the dead end of some main or at some burner where a quantity of stale gas had been hanging about for a considerable time. The law provided that the gas should be tested at certain places. They had thirteen of these testing-stations; and when he told the shareholders that the cost of fitting up the necessary instruments for these stations was £500, they could understand how delicate they were, and how ridiculous it was to suppose that the matter could be properly dealt with by carrying round the suggested portable photometer. They would resist to the utmost the imposition of any such method of testing gas; and he was certain that Parliament would not sanction it. Regarding the charge itself, it was just as ridiculous as it would be to say that the Water Companies could send through the same main clean water for drinking and dirty water for other purposes. It was impossible for them to distribute through their mains two qualities of gas. They sent through them gas which had been tested in accordance with the law; and they declined to have any hole-and-corner testing. It was wonderful what an amount of newspaper reading one had when one was connected with a gas company; and the proprietors might also have noticed in the papers that there had been an agitation with respect to the reduction in the price of gas. In 1889 they were paying for coal and wages at the rate of only 6s. 3d. per ton; and if they were in this condition now, they would do the same as they did then. Their price then went down to 2s. 6d. per 1000 cubic feet. However, at December last their coal and wages cost them 7s. 6½d. per ton; while at the present time these two items probably came to 9s. at least. Moreover, the cost of repairs and other items of working expenses were certainly higher than they were five years ago. There was no mystery or magic in the manufacture of gas. The cost depended, and must depend, entirely, or almost entirely, upon the cost of the raw material *plus* the cost of production, less the residuals, which, however, entered into the element of cost of production. With respect to wages, too, the tendency now-a-days was to increase them by shortening hours and restricting work; and he did not think the public should expect any relief under this head at all, except such as might be obtained by the substitution of machinery for hand labour. One, however, almost shrank now from doing anything which should reduce the labour of the people of this country; but a few years ago they used to pay 4d. per ton for the handling of their coal. At the Mansion House they were asked by Sir James Whitehead, when that gentleman was Lord Mayor, by the late Cardinal Manning, Sir John Lubbock, and Mr. Sydney Buxton, to continue paying the 4d.; and they did so for some time, being promised another meeting on the subject. They could not, however, get this other meeting, and the 4d. went on.

Mr. LIVESEY: The price was raised by the coal porters only to 4d.

The GOVERNOR said they had to pay this 4d. until they could get rid of the burden; and they did this by substituting machinery. The result of this has been to reduce the price from 4d. to 1⅜d. per ton; and instead of employing six men they employed two. All these combinations, whether they were to raise artificially the price of labour or of coal, must end in disappointment to those who attempted them, because there was always a way out of the difficulty by adopting some other method. The gentlemen who had established a League with a view of reducing the price of gas—two of them were Members of Parliament—and who proposed to have a parliamentary inquiry, had dwelt very strongly on the different prices charged by The Gaslight and Coke Company and the South Metropolitan Company on the other side of the river. As regarded the inquiry, as far as their Company was concerned, they were perfectly welcome to it. Indeed, the Directors would be rather glad to have an inquiry, as it would clear away some of the County Council cobwebs, and the public would see how their interests were looked after. As a matter of fact, the Company was a large co-operative concern. They received a comparatively small interest on the capital employed; and the bulk of the profit went in reducing the price to the consumer. As he had repeatedly said, and as Mr. Livesey had frequently pointed out in print, every penny per 1000 cubic feet in the Company meant, approximately, £80,000 up or down. If they increased the price of gas by 1d., the public paid £80,000 more; while if they reduced it by this amount, the public paid £80,000 less. But out of the £80,000 more which the public paid, the Company lost £15,000; whereas, on the other hand, if they reduced their price they gained £15,000—that being the extra ¼ per cent. dividend they might then pay—the public gaining the other £65,000. The consumer, in this co-operative concern, had by far the largest interest in the carrying on of the undertaking. With respect to the difference in the price charged by the two Companies, it would naturally strike everyone. People said: "Why should we pay 3s. 1d. for gas on the north side of the Thames, when we can get it for 2s. 5d. on the south side from the South Metropolitan Company?" It was a very difficult and a very technical question to deal with; but as it had been raised so frequently, he had deemed it advisable to draw up a memorandum on the subject, and he thought this would almost, if not entirely, account for the difference in a satisfactory way. He would read the memorandum, and afterwards explain any point in it if he were asked to do so. [The Governor then read the document, which stated that the question of the difference in price charged by the Company and the South Metropolitan Company was one which was almost constantly being raised; and the answer was to be found in the unique position of their Company, first as to the requirements of its district on a foggy day or a series of foggy days, such as was common in London in a normal winter, which constituted what was known as a load factor. The Company's annual sale of gas, taking the average of the three normal years 1890, 1891, and 1892, was exactly three times that of the South Metropolitan Company; but The Gaslight and Coke Company's maximum daily delivery, which must be the only basis of calculation adopted when estimating what manufacturing and other plant had to be provided, was 3½ times that of the South Metropolitan Company. Taking that Company's actual capital expenditure, allowance having been made for small conversions in past years, and multiplying this by 3½, it came to £11,700,000. Their own capital expenditure amounted to £11,400,000; and deducting from this the approximate expenditure incurred in closing the old in-town stations, and transferring their manufacture to Beckton, £700,000, their net capital expenditure had been £10,700,000, or just £1,000,000 below that of the South Metropolitan Company. This showed that the capital expenditure of The Gaslight and Coke Company had been neither excessive nor extravagant, although it amounted in the whole year to a larger figure per ton of coal than that of the South Metropolitan Company. The net cost for interest on this larger figure per ton of extra capital was equal to 2·85d. per 1000 cubic feet. Then, plant having been erected, it had to be kept in repair; and, unfortunately, there was a large amount of wear and tear going on in gas-works, both when they were only partially used and when they were out of use. So that, for the purpose of such comparisons as were now being made, wear and tear must be calculated on the amount spent on works and plant. Applying this principle to the two Companies, it would be found that The Gaslight and Coke Company spent in 1893 upon wear and tear a sum equal to 3·84 per cent. upon their total capital expenditure, while the South Metropolitan Company's wear and tear expenditure was 4·65 per cent. on their capital expenditure. These figures were just what one would have expected to find; but their own wear and tear really cost them on their annual sale 0·57d. per 1000 cubic feet more than the South Metropolitan Company's cost them. A third item accounting for the difference was that of rates. The Gaslight and Coke Company had to demand a higher price for their gas in order to meet the charge for capital; and this enabled the parishes to assess the Company at a proportionately enhanced value. This approximately amounted to 0·96d. per 1000 cubic feet. There were also other causes of difference. At Beckton there was absolutely no local trade for the 400,000 tons of coke made there, the whole of which had to be sold at about 2s. 6d. per ton below London prices; and the same condition applied, though in a less degree, to Bromley. This drawback was especially felt in the past half year, because, during the recent coal strike, only a small portion of their coke was sold at the greatly enhanced figures then ruling; the bulk being disposed of at prices which were very little above the normal rate. At all The Gaslight and Coke Company's canal stations, they incurred very heavy dues, &c., upon the coal sent up to them, and upon the tar and ammoniacal liquor brought down. These items represented in 1893 1·38d. per 1000 cubic feet upon the whole gas sales of the Company. The net difference in the price charged between the two Companies in 1893 was 7·21d.] He would recapitulate the figures he had given them. He had shown that, of this 7·21d. difference, capital represented 2·85d.; wear and tear, 0·57d.; taxes, 0·96d.; and Beckton and Bromley coke and the canal station expenses and losses, 1·38d.—or a total of 5·76d. Then, their Company's surplus in 1893 was in excess of the South Metropolitan Company's to the extent of 0·44d. The only other item was the current coal contracts, which in the June half year were less favourable to their Company than to the South Metropolitan Company to the extent of about 1d. The Gaslight and Coke Company's contracts were made at different times. They had still a great deal of their cheap coal to come in; but last half year the difference between the two Companies, of almost 1d., was on account of their having a great quantity of the dearer coal in stock. Adding these figures together, they accounted for the whole difference. If it were not for the peculiar conditions of the Company's supply, which no management of theirs could alter (it being the nature of the district), they would be able to sell gas at the same price as the South Metropolitan Company; and if they had a return to their normal rate of increase of sale—which, when this exceptional weather had passed away, they might hope for—they expected that their prices would approach more nearly to those of their neighbours. He did not suppose for one moment that this explanation would satisfy Mr. James Rowlands, who would still want his parliamentary inquiry, to which he was quite welcome, as far as the Directors were concerned. They were, however, convinced, after going very carefully into the figures, that this was the explanation of the difference in the two prices. With respect to the demand for a reduction in price at the present time, he had in his hand a list of 30 gas companies and municipalities which, during the past half year, had given notice of increases in their charges—in some cases by 6d., in others by 4d., 3d., and 2½d; making an average of about 4½d. per 1000 cubic feet. The report contained a personal paragraph with respect to their colleague, Sir Hugh Adair. They all deeply regretted that this gentleman had felt it his duty not to offer himself for re-election, for he had been a most valuable and congenial colleague. They had been at the Board "a happy family." They did not agree on every question; but when they differed, they argued the point out, and settled it without the introduction of any feeling whatever. He repeated that they deeply regretted their colleague's desire to retire. It was the wish of a great many of the proprietors—and he believed a very general wish—that, whenever a vacancy occurred on the Board, the Directors should endeavour to obtain the services of Mr. John Orwell Phillips. He was happy to say that Mr. Phillips, who was very ill a year ago, was much better now, although he was far from being in a state of robust health; but there was a great difference between sitting at a Board once a week, and sitting in the office from 9 till 5 o'clock every day. The responsibility and work attaching to Mr. Phillips's former duties no doubt hastened the breakdown of his health; but he was sufficiently restored to enable him to render the Company efficient service on the Board, and the Directors hoped the shareholders would approve his election to the vacancy.

The DEPUTY-GOVERNOR (Mr. H. C. Ward), in seconding the motion, said that he only desired to make one remark, which had reference to the great decrease in the consumption of gas in their district. He wanted to reassure them respecting that matter, in this way: He himself had had very considerable experience in the operations of another Company, where there was no electric light whatever to come into competition; and they had found in that case very much the same causes had also been at work. They had had a reduction there somewhat approaching that which had happened in their own case; but

he only mentioned the fact in order to show them that the diminution in consumption was really attributable to the exceptional state of the weather, both as regarded the increase of temperature and the hours of sunlight.

The GOVERNOR, in answer to a question, said that the coal contracts terminated from year to year.

A SHAREHOLDER asked whether the memorandum which had been read by the Governor, explaining the difference in the charge for gas between their Company and the South Metropolitan Company, could not be circulated among the shareholders. He believed it would be valuable for them to have at hand as an answer to their enemies.

The GOVERNOR, in reply, said that there would be no difficulty in acceding to this suggestion. As he had said at the outset, it was a calculation based upon working, not actual, capital; and, with a proper preface, it should be circulated, as desired.

The motion was then unanimously adopted; and resolutions were afterwards passed approving the dividends, and re-electing the retiring Directors (Colonel Makins and Mr. Ward).

The GOVERNOR then proposed the election of Mr. John Orwell Phillips as a Director, to fill the vacancy caused by the retirement of Sir Hugh Adair. He said he had intended to propose the resolution in a very few words, as Mr. Phillips was as well known to the proprietors as he was to the Directors; but an extraordinary document reached him the previous morning, headed "Gaslight and Coke Company. More Jobbery." It was signed, not by the name of the shareholder, but "Truth." He then read the circular; and, in reply to the eight questions which it contained, said: (1) Mr. Phillips's salary at the time of his retirement was £3500. His pension was £2800, which was 32-40ths of his salary. Mr. Phillips had served the Company for 32 years; and the Directors had assumed—and the proprietors endorsed it by their resolution—that if he had gone on for 40 years, he would have been entitled to retire on full pay. (2) The letter of Sir Hugh Adair stating that he would not seek re-election was written on Jan. 11, and it reached him (the speaker) on the 13th. He received it in the course of post; and he laid it before the Court on the 19th. The Court expressed, by resolution, their extreme regret that Sir Hugh Adair did not intend to seek re-election; and they decided to recommend Mr. Phillips to the shareholders to fill the vacancy. (3) "How did Mr. Phillips learn that there would be a vacancy?" The answer to that was, through himself, the speaker. (4) Mr. Phillips did not intimate his intention in writing to be a candidate for the vacancy. There was no need for him to do so, and no regulation requiring him to do so. (5) Sir Hugh Adair's retirement was made known to the proprietors in the usual way—by notification in the Directors' report. (6) He gave an emphatic negative to the question "Has any member of the Board been directly or indirectly interested in any contract with the Company for work or for coal. (7) Contracts were not "settled by 'the Manager.'" (8) As he said at the last meeting, the salary of Mr. Field, up to the time of his election as Manager, was £1500; and an additional £500 was added in respect of his duties as Secretary, making £2000. The circular concluded as follows: "A meeting of shareholders will shortly be held at the Bridge House Hotel, London Bridge, to overhaul the affairs of the Company, and to decide upon a course of action to secure a change in the directorate and in the official staff." If it was intended to hold such a meeting, the Directors would offer the shareholders the room in which they were then assembled for the purpose. The circular, as he had said, was signed "Truth;" but the signature ought to have been "Calumny." He did not know whether the person who issued it was present; but, if so, he (the speaker) said that it was a most disgraceful document, and that the conduct of the shareholder in issuing it was mean and contemptible. But for the fact that these matters belonged to the shareholders, it would have been beneath the Directors to take any notice of it.

The DEPUTY-GOVERNOR seconded the motion; and, in answer to Mr. Snowden, said he had seen Mr. Phillips lately, and the state of his health would enable him to undertake the duties of a Director.

The GOVERNOR then put the resolution in the usual way, and declared it carried unanimously; adding that he thanked them for their answer to the cowardly circular referred to. Continuing, he said that, on Mr. Phillips's retirement, the officials desired to present him with a testimonial; but Mr. Phillips would only agree to sit for his portrait. This had been painted by Mr. Wells, and was on the staircase above them. If any shareholder would like to see it, the opportunity to do so would be gladly afforded him.

On the motion of Mr. A. FRASER, a resolution was passed conveying to Sir Hugh Adair the thanks of the shareholders for his long and valuable services to the Company as a Director.

The GOVERNOR said that the Directors had already passed a vote on the subject; but he was sure that it would be very gratifying to Sir Hugh Adair to find that the proprietors had endorsed the expression of regret which had been made on the part of the Board.

A vote of thanks to the Governor terminated the proceedings.

The Use of Gas for Railway Carriage Lighting.—The Directors of the Great Southern and Western Railway of Ireland announce, in their half-yearly report, that the lighting of their carriages by gas has proceeded satisfactorily during the past six months; and before next winter, it is expected that the whole of the main line trains, together with some of the branch trains, will be so lighted.

The Proposal to Establish Municipal Gas-Works at Liverpool.—At the meeting of the Watch Committee of the Liverpool City Council yesterday week, the Town Clerk, in accordance with the instructions of the Committee, presented a report in which he expressed the opinion that the Corporation are not at present empowered to establish and maintain gas-works. To do so would, he considered, require a Special Act of Parliament. After a protracted discussion, the Town Clerk was asked to inform the Gas Company that the Committee regretted the Company would not reduce the price of gas for public lighting; and, further, that the Committee could not recommend the Council to agree to pay the increased price demanded by the Company pending the examination of their accounts by the City Auditor.

BRENTFORD GAS COMPANY.

Half-Yearly Report and Accounts.

The accounts which will be presented to the shareholders of the above Company at their meeting next Friday disclose a considerable improvement on the corresponding period of last year—this being mainly due to the larger receipts for coke and ammoniacal liquor, and the lessened expenditure on coal. The receipts for gas amounted to £93,947, which, compared with the corresponding period of 1892, was a drop of about £800; but both the meter and stove rental showed rather better figures—meters returning £3014, as against £2921; and stoves £896, as against £840. The receipts for residuals were as follows; the amounts in parentheses being for the December half of 1892: Coke, £15,419 (£13,128); breeze, £80 (£92); tar, £2289 (£3653); and ammoniacal liquor, £4949 (£3811)—total £22,737 (£20,684). The "rents receivable" £71, and the transfer fees £11, make up the total revenue of £120,677, as compared with £119,316. On the opposite side of the account, it is seen that the manufacturing expenses came to £61,617, the principal items of which were: Coal, £38,443 (against £45,336); carbonizing wages, £10,093 (£10,769); and repairs and maintenance of works, £9611 (£8623). There were no considerable changes under the other heads of expenditure, the totals of which were as follows: Distribution, £7076; public lamps, £1363; rents, rates, and taxes, £4827; management, £3739; law charges, £252; bad debts, £483; Official Auditor, £25; and pensions and provident fund, £204. The total outlay was £79,588, which was £6346 less than in the second half of 1892—the balance carried forward being £41,089, as compared with £33,382. The sum available for dividends is £51,937, from which the Directors recommend the declaration of the following dividends, subject to income-tax. At the rate of 5 per cent. per annum on the 5 per cent. preference stock; at the rate of 11½ per cent. on the consolidated stock; and at the rate of 8½ per cent. on the new 1881 stock. With reference to the manufacturing operations, the quantity of coal carbonized during the six months was 58,587 tons, and of cannel 851 tons; and this yielded 611,178,000 cubic feet of gas. The estimated quantities of residual products were: Coke, 38,383 tons; breeze, 4854 tons; tar, 590,068 gallons; and ammoniacal liquor, 19,155 butts of 108 gallons, including 368 butts purchased. In their report, the Directors mention that, through ill-health, Mr. J. Sewell Neville has had to resign his seat at the Board; and they have elected Mr. R. J. Neville-Neville to succeed his father.

NEWCASTLE AND GATESHEAD GAS COMPANY.

Annual Report.

The report of the Directors of the above Company for the year ending Dec. 31 last has been issued. It states that the revenue was £208,472, and the expenditure £152,479; leaving a balance of £55,993 as the profit for the year. Adding to this the balance of undivided profits from 1892 (£15,226) makes £71,219, which it is proposed to appropriate as follows: Interest on debenture stock, loans, and prepaid stock, £5996; intermediate dividend of £4 17s. 6d. per cent., less income-tax, on £592,000 stock, £28,078; to the payment of the second half-year's dividend, at £4 17s. 6d. per cent., on £600,000, £28,396 17s. 6d.—making a total of £62,471, and leaving a balance to be carried forward to next year's account of £8748. The report proceeds: There is an increase in the receipts as compared with last year of £11,564, and a decrease in the expenditure of £19,428. The reduction in the price of gas which was made two years ago has not been attended with the results anticipated; and the contracts for coals for the current year being made at enhanced prices, the Directors have resolved to advance the price of gas, from the 1st of July of this year, to 2s. per 1000 cubic feet, less the usual discount. The receipts from coke and tar are much about the same as in the previous year; but there has been a considerable increase in the prices realized for sulphate of ammonia, which the Directors have every reason to believe will be continued. The whole of the capital authorized by the proprietors to be raised having been exhausted, the Directors intend asking power at the meeting of shareholders to sell £34,615 consolidated stock; being the balance of the amount authorized by the Act of 1879. During the year, 10½ miles of pipes have been laid in extensions and renewals, 1483 new branches have been laid, and 2550 old branches renewed; 1153 meters have been repaired, tested, and refixed; 305 ordinary street lamps have been erected; 23 specially large lamps fitted up for private consumers; and there is an increase of 252 cooking-stoves fixed—making the total number on hire 1829. The large gasholder at Redheugh has been completed, and has been available during the winter. After referring to the Directors retiring by rotation, the report concludes with these remarks concerning the Auditors: "The Auditors (Messrs. J. H. Richardson and R. Y. Green) also retire, but do not offer themselves for re-election. By the Gas Company's Act of 1879, a competent public accountant, named by the Company and approved by the Corporations of Newcastle and Gateshead, is appointed to audit the accounts. The Directors do not see the necessity of appointing others; but leave the matter to the discretion of the proprietors."

A Social Gathering at the Dover Gas-Works.—Since the establishment of the reading and recreation room at the Dover Gas-Works about seven years ago, it has been the scene of some exceedingly instructive entertainments, given under the presidency of Mr. R. Herring, the Company's Manager. The latest of these pleasant gatherings took place on the 25th ult., when the room was tastefully decorated for a smoking concert. During the evening, the President presented to Mr. H. Harman, the Honorary Secretary to the Committee of Management, a very fine silver-mounted Malacca cane, bearing a suitable inscription, as an acknowledgment of the efficiency with which he had discharged his duties. In making the presentation, Mr. Herring emphasized the importance of unity prevailing between the Directors and the employees. Mr. Harman suitably responded.

PROVINCIAL GAS AND WATER COMPANIES.

We record below the most noticeable points of the reports and accounts of Provincial Gas and Water Companies which have come to hand during the past few days.

Gas Companies.

It was reported at the meeting of the Chester Gas Company last Thursday that a new gasholder was in course of construction, at an estimated cost of £8000. To meet this, the Board proposed to issue further capital under their borrowing powers. There had been an increase in the cost of coal of more than £2300, caused entirely by the strike. The return from residuals had improved; but there was a diminution in the gas-rental. The Directors recommended the payment of the statutory dividends, which would necessitate the withdrawal of £2112 from the reserve fund.

Considering the circumstances of the past half year, it is satisfactory to find that the Directors of the Dorchester Gas Company are able to report a small increase in the consumption of gas. The profits amount to £1143; and from this sum dividends are recommended at the rates per annum of 10 per cent. (free of income-tax) on the ordinary capital and 6 per cent. (less income-tax) on the preference capital. After paying these, £125 will be left to be carried forward to the net revenue account, from which £75 will be transferred to the credit of the reserve fund.

The result of the working of the Grantham Gas Company during the last six months enabled the Directors to recommend, at the meeting of the shareholders on Monday last week, a dividend of 5 per cent. on the old shares and 3½ per cent. on the new shares. The Chairman (Dr. Jeans), in moving the adoption of the report, remarked that the late coal strike had caused much trouble, anxiety, and also expense. At the same time, they were better off than many other gas companies, having looked well ahead, and having laid in a stock of coal which would have well covered a strike of ordinary duration. The report was adopted.

The report of the Directors of the Malton Gas Company (which was passed at the half-yearly meeting of the shareholders last Wednesday) stated that there was an available balance, after providing for all charges and interest, of £1747. They therefore recommended a dividend at the rate of 10 per cent. per annum, free of income-tax. The quantity of gas sold had increased during the six months by 8¼ per cent. compared with the corresponding period of 1892. The system of supplying gas by "penny-in-the-slot" meters had been adopted; and there were now 30 of these meters at work.

The report of the Directors of the Reading Gas Company has been issued in anticipation of the half-yearly general meeting on the 20th inst. After a brief reference to the anxiety caused by the prolonged dispute in the coal trade, the Directors state that, owing to the careful and thoughtful management of the Company's Engineer (Mr. E. Baker, Assoc.M.Inst.C.E.), and to the fact that there has been an additional quantity of gas sold for heating and other purposes, as well as an advance in the value of the residual products, they can recommend the payment of maximum dividends upon all the stocks and shares of the Company. The accounts accompanying the report show that the balance available for this purpose is £14,925. The receipts in the six months ending Dec. 31 last amounted to £28,096; the expenditure, to £23,272—leaving a balance of £4824 to go to the net revenue account. Since the last half-yearly meeting, further progress has been made in the extension of the new works. An additional amount of capital to meet the balance of contracts and expenditure for these works will be required; and permission to raise it will be sought at the forthcoming meeting. With regard to the working, the coal carbonized was 14,227 tons; and the quantity of gas sold, 147¼ million cubic feet. The residuals produced were: Coke, 14,227 chaldrons; tar, 143,296 gallons; sulphate of ammonia, 122 tons 16 cwt.

The report presented by the Directors of the Scarborough Gas Company at their half-yearly general meeting last Saturday stated that the net revenue for the six months ending Dec. 31 last, including the amount brought forward, was £6488, out of which, after providing for the dividend on the preference stock, the Directors recommended the payment of the maximum dividends, less income-tax, on all the other stock of the Company. This would absorb £5246, and leave a balance of £1242 to be carried forward. The late dispute between the colliery proprietors and the miners did not affect the Company as largely as might have been anticipated. Although it was necessary to purchase, during the period of dispute, a considerable quantity of coal in the open market at a higher rate than the contract prices, yet the increase in the bulk of gas consumed, and a slightly higher return for residual products, together with a reduction in the working expenses, compensated to some extent for the extra cost. The consumption of gas for heating and cooking purposes showed a satisfactory increase; and the Directors expressed the belief that there was also an extended demand for gas for various purposes in cottage property. With the view of meeting this, they were introducing a limited number of prepayment meters as a trial. Reference was made to the loss the Board had sustained by the death of their late esteemed Secretary and Manager (Mr. W. J. Moon), and to the appointment as his successor of Mr. J. Holliday, Assoc.M.Inst.C.E., F.C.S., who was previously Sub-Manager. The accounts accompanying the report showed that about 11,600 tons of raw material were carbonized in the past half year; the sale of gas being 108¼ million cubic feet for ordinary consumption, and 10¾ million cubic feet for public lighting and under contracts. With regard to residuals, of the 7017 tons of coke made, 2814 tons were used in manufacture. The other products were 694 tons of tar and 1234 tons of liquor. The report was adopted; and the dividends recommended were declared.

In reviewing their accounts for the past half year, the Directors of the Weymouth Consumers' Gas Company find evidence of that which cannot be regarded as other than satisfactory working. They are pleased to be able to report that the business remains upon a firm basis, and shows a gradual expansion. There is a moderate increase in the receipts from the sale of gas; the returns from residual products and fittings have been somewhat better; while the coal account, notwithstanding the disturbed state of the market, does not call for unfavourable notice. The receipts for the half year amounted to £6727, which was produced as follows: Sale of 27,758,800 cubic feet of gas, £5489; meter-rental, £123; residual products, £924; and gas-fittings, £191. The working expenses totalled to £4341, of which £2407 was absorbed in the purchase and delivery on the works of 3265 tons of coal. The profits are therefore £2386; and the balance on net revenue account is £2816. The amount earned will suffice for the payment of a dividend at the maximum rates, after providing for the interest on debenture bonds. The Directors therefore recommend that dividends be declared at the rates per annum of 10 per cent. on the ordinary "A" stock and 7 per cent. on the ordinary shares.

At the half-yearly meeting of the Willenhall Gas Company last Wednesday, the report presented by the Directors stated that there was a balance on revenue account of £885. It was decided to pay the standard rates of dividend on the various classes of shares, for which purpose it would be necessary to transfer £120 from the reserve fund. The recent coal strike was said to have seriously affected the Company; and to meet the loss incurred, the price of gas had had to be raised 3d. per 1000 cubic feet from November last. The new works erected at Short Heath, it was also mentioned, had been in successful operation since Nov. 2, and had enabled the Company to maintain an abundant supply throughout the most trying period of the year.

Water Companies.

The Camborne Water Company have a disposable balance of £845 on the past half-year's working; and the Directors propose the payment of dividends at the rates per annum of 8 per cent. on the "A" shares, and £5 12s. per cent. on the "B" shares. The total amount of capital spent on the works is £24,154.

The half-yearly general meeting of the Chester Water Company was held last Thursday, when the accounts presented showed a surplus of £2594. Adding the balance brought forward—£4926—made a total of £7520. After payment of the interest on the preference capital, amounting to £450, there was an available balance of £7070, out of which dividends at the rate of 7½ and 7 per cent. per annum, free of income-tax, upon the consolidated and ordinary stocks were declared. The Engineer (Mr. G. Crowe) reported that the Company's works had been maintained in good order and repair.

The accounts of the Grantham Water Company for the half year ending Dec. 31 last showed a balance in hand of £4811; and from this a dividend of 5 per cent. for the six months was declared at the meeting of shareholders yesterday week.

The Hawarden and District Water Company held their half-yearly meeting last Saturday, when an increase of £149 in the total receipts, and a decrease of £17 in the expenditure, were shown, as compared with the six months ending Dec. 31, 1892. The total net profit was £623, which was sufficient to pay interest and a dividend at the rate of 3¾ per cent. per annum. The Directors, however, recommended that the dividend should be 3 per cent., and that £59 should be used in reducing the overdraft at the bank, and £59 carried forward. The Directors thought the accounts gave evidence of a steady and continuous increase in the Company's business, notwithstanding that the exceptional drought experienced in the spring and summer months of the past year caused a certain unavoidable curtailment of business, and consequently of revenue.

The report to be presented to the shareholders of the South Staffordshire Water Company at their half-yearly meeting on the 22nd inst. shows that the gross amount of water-rates for the six months ending Dec. 31 last was £42,000, as compared with £40,243 in the corresponding period of 1892. The number of houses furnished with supplies was 2079; making a total of 81,494 houses connected with the Company's mains at the close of the year. The Directors have transferred a further sum of £1000 to the depreciation fund, which now stands at £7566. The balance available for distribution, inclusive of £3001 brought forward, is £18,613; and the Directors recommend the declaration of a dividend on the ordinary stock at the rate of 5½ per cent. per annum, less income-tax. This will leave £3084 to be carried forward. The Engineer (Mr. W. Vawdrey) reports that the machinery, reservoirs, and plant of the Company are in good order and substantial repair.

The annual meeting of the Weardale and Shildon Water Company was held on Monday last week, when some additional information to that contained in the report and accounts—noticed last week—was given by the Chairman (Mr. David Dale). He said the capital expenditure during the year had been £6822. This had arisen mainly through the laying of the pipe-line between Waskerley and Tow Law, by reason of the insufficiency of the diameter of the existing pipe to convey all the water which it was necessary to carry between those two points. The estimated cost was rather more than the actual outlay, which was £6727. The gross receipts for the year were £37,604, as compared with £33,075 for 1892, or an increase of £4528. The working expenses for 1892 were £6513; while for 1893 they were £7520, or an increase of £1006. Then there were certain slight variations which brought up the total increase of working expenses to £1026. But £500 of the expenditure on the pipe-line already referred to was debited to revenue; and £200 was spent in making temporary arrangements for raising water from the lower level of the Tunstall supply to the higher level of the Waskerley pipe-line. Therefore the working expenses were really brought down to a little more than £300. At the beginning of the year, they brought forward an undivided profit of £3379; and, after paying a dividend of 4¾ per cent. for the year, they would carry over £4686. The report and accounts were adopted, the dividend declared, and a special resolution passed, authorizing the Directors to issue further capital to the amount of £100,000. With reference to this last matter, the Chairman explained that the view of the Directors was that it would improve the stability of the Company if, instead of borrowing as they were now doing sums for limited periods, subject to redemption at short notice, they were to issue £100,000 additional capital. It would be seen, on referring to the credit side of the capital account, that the loans on Dec. 31 amounted to £57,430, and that there had been spent on capital account £8580 more than had been received; this sum having to be borrowed from revenue. Altogether this represented practically £60,000 of expenditure on capital account not represented as share capital.

THE GAS QUESTION IN DUBLIN.

A Discussion in the City Council.

At the Meeting of the Dublin Corporation on Monday last week—the Right Hon. the LORD MAYOR (Alderman V. B. Dillon) in the chair—the report of the Special Gas Committee, which was noticed, in connection with the reply thereto of Mr. W. F. Cotton, the Secretary and General Manager of the Alliance and Dublin Consumers' Gas Company, in the JOURNAL for Dec. 26 last, came up for discussion.

The TOWN CLERK opened the proceedings by reading the following letter, addressed by Professor Tichborne, the Board of Trade Gas Examiner, to the Lord Mayor and the members of the Paving and Lighting Committee:—

In the report of the Special Gas Committee, I see a reference to the discrepancies observable between the testings of the Inspector of Public Lighting and myself. Allow me to point out that these discrepancies are no new thing, but have been going on from the second week that Mr. Thomas Cotton began to test. I have frequently drawn attention to it, and have from time to time asked that some of the Gas Committee and Mr. Thomas Cotton should meet me, so that we could test together, and see if we could possibly discover where these discrepancies came in. I did so by word of mouth to members of the Gas Committee, and twice by letters addressed to the Paving and Lighting Committee. The letters were handed over to your Gas Committee for reply. As they refused, I was reluctantly compelled to draw the inference that they did not wish to investigate it. With extreme surprise, I observe in their report a table of what purports to be my testings for the months of September and October, 1893. I find that it is a garbled report, in which the highest testings are given and many left out. The remarks which follow show a wonderful want of knowledge of the gas question. The Gas Company are not supposed to supply exactly 16 candles, nor could they do so; but 16 candles is the minimum which they should supply. Everyone who knows anything about gas making is aware that they can never make gas two days running of exactly the same illuminating power. Even the same gas from the same coal will fall or rise, with a sudden change of temperature or pressure, one-quarter of a candle, and in extreme cases as much as one candle. My tests for the months of September and October give exactly an average of 16·5, which represents that the Gas Company for these last two months in the year were supplying 16·5 candles, or half a candle over the minimum—not a candle, as stated in the report. The Inspector's method of "determining the deficiency in the illuminating power of the gas *without any test*" is not likely to carry much weight, and is not one I adopt. Also allow me to draw, with great respect, the Paving and Lighting Committee's attention to the fact that the tests contrasted with mine are really of no *legal or moral value*, because (1) they were not performed according to the Gas-Works Clauses Act or the Arbitrator's regulations; (2) they were not made at the official testing-station; and (3) they were made with an unknown instrument.

He also read a letter from Mr. W. F. Cotton, dated the 6th of October last, and asking the Corporation to concur with the Directors of the Company in having an arbitration. He also read a letter of the 14th of October from Mr. T. J. Cotton, Secretary of the Special Gas Committee, stating that the Committee were convinced that there was nothing upon which an arbitration should be held, as they had complied with the award, which it was hoped would "put an end to this unpleasant discussion."

The LORD MAYOR then proceeded to move the following resolution standing in his name: "That the report be adopted. That the members now constituting the Electric Light Committee, with one member taken from each ward not now represented on the Electric Light Committee, do constitute for the year 1894 a Committee to be called the Lighting Committee; that all the duties and powers of the Paving and Lighting Committee, of the Electric Light Committee, and of the Special Gas Committee, with respect to lighting, be transferred to, and vested in the Lighting Committee; that the said Committee may keep separate accounts and separately manage the electric lighting and the gas lighting, and report to the Council at least once in every three months; that the members now constituting the Electric Light Committee shall co-opt to the Lighting Committee one of the members for each ward not now represented on the Committee." After a few prefatory remarks, he said the question the Council had to consider was a very simple one. It was whether they would adopt the recommendation of a Committee that had given continuous and assiduous attention to the subject before them, or whether they would take the views expressed by Mr. Cotton and others on behalf of the Gas Company. The position was shortly this: Some time ago, an award was made as the result of litigation between the Company and the Corporation, which the Gas Committee had earnestly hoped would put an end to the trouble. He did not hesitate to say that, since the award was made, no disposition had been shown on the part of the Company to carry out its provisions fairly and reasonably; but they had set themselves in a position of antagonism to the Corporation. It must be borne in mind hat the Corporation did not represent the public lighting exclusively in this matter. Every consumer of gas in the city was interested in the question. Every consumer was interested in ascertaining whether or not Professor Tichborne's returns of 17 and 17½ candle gas, when the Company were only obliged to supply 16 candles, or Mr. Cotton's tests, which showed a supply of 13 or 14 candle gas—a little more on one side than Professor Tichborne was on the other—was correct. He asked them to put their trust in their own officer—to believe that he had acted in their interests, whatever animosity existed between him and the Company. The purchase of the lighting plant had been settled by arbitration, which was not favourable to the Corporation, as they had to pay for it £3000 or £4000 more than it was worth. Since then they had put new meters in the lamps. These had been purchased from one of two persons suggested by the Company; but a conflict existed between them and the Committee in reference to them. The Committee had been forced, at the point of the legal bayonet, to drive the Company to establish a testing-station and furnish it. Now they alleged that the instruments in the station were not of the proper character. On the other hand, the Company set up a rather curious contention. They said that in the year 1850 or thereabouts, or certainly between 20 and 30 years ago, an Act of Parliament was passed, prescribing that a particular kind of photometer then in use, and supposed to be at the time sufficiently good, was the one to be used by local authorities in the control of the quality of the gas. Since that time, as they all knew, science had been advancing. The science of testing gas had not lagged behind; and one of the things the Corporation had to do was to refuse to test the gas they were being supplied with by an instrument that was 20 years old at least, and had been rejected by the makers because they had improved upon it. There were other matters of contention as well as this. One of the tests for gas was the quality of its light; while another was for its impurities. For the last 20 or 30 years, the gas had not been tested for impurities in Dublin. In his opinion, this was a disgraceful thing for the Corporation; and the sooner they took it into their hands and set it right, the better. He thought this matter should be entrusted to a Special Committee, which originally consisted of nine members; but now there were only three remaining. The report had been before the Council for some time. He had drawn it; and he believed he had put the question before them fairly and impartially. What he wished chiefly to enforce now was the desirability of entrusting this matter to a Committee who would deal firmly and well with it.

Alderman MULLIGAN seconded the motion.

Alderman GILL asked the Lord Mayor if Mr. Thomas Cotton had been working since October last with the same instruments that he used in September and October.

The LORD MAYOR: Yes; the same.

Sir R. SEXTON asked if Professor Tichborne used the same instruments as Mr. Cotton.

The LORD MAYOR said he did not. Mr. Cotton tested with the instruments provided by the Corporation at their public lighting station; and they had been stamped by the Board of Trade as proper testing instruments. Professor Tichborne had been using up to now an Evans photometer, which had not been stamped by the Board of Trade, and which the Company refused to allow to be sent to the Board to be stamped, because they said there was no legal obligation on them to do so. Professor Tichborne would, in future, test with an instrument 25 years old, which the Board of Trade refused to stamp.

Sir R. SEXTON asked if Professor Tichborne was not an officer of the Board of Trade.

The LORD MAYOR said he thought the Professor's position was an extremely anomalous one. He added, in reply to another question, that the proposed Committee would be one for the year 1894. After that it would be open to the Council to reconstitute it, if they did not find it satisfactory.

Mr. SHANKS then, in a long speech, proceeded to discuss the whole question from the ratepayers' point of view. He said he found that the report of the Committee was more remarkable for what it suppressed than for what it revealed. It suppressed the fact that, while the gas lighting department of the Corporation had been under the control of the Special Committee, the annual expenditure, exclusive of payments for gas, had risen by the substantial sum of £2600 a year. And what, he asked, was the benefit derived? The Committee claimed to have reduced the yearly outlay on gas by £1490. This was the actual sum paid less for gas as compared with the expenditure of 1888; and in a footnote to their report, the Committee stated that there was a reduction of £268 estimated on the introduction of the electric light in 1892. It was a funny thing that the City Accountant estimated the reduction on that account as £336 3s. 11d. for the half year; and this would be £653 for the twelve months. This made a big hole in the £1400. Most important of all was the reduction due to the discount of 10 per cent. allowed by the Company as a result of the award. In 1882 the Company had offered the reduction of 10 per cent. for a three-years' contract; but this offer was refused by the Corporation. For several years the amount was paid in full, although it might have been paid at a discount of 10 per cent. As they knew also, the time of lighting had been reduced by half an hour; and they had complaints from artizans and others about groping in darkness to their work. Now it did not require £2600 additional expenditure to bring about the results to which the Committee had pointed. It was a proof to him that (he hoped it was so no longer) it had been true that a few individuals in the Council might so get the ear of that body that they would be at liberty to carry out their "fads" without regard to the cost to the ratepayers. He then went on to refer to the Company's position, and said they could exact from the consumers such a price for gas as would enable them to pay a 10½ per cent. dividend on their ordinary stock; and this constituted an incubus on the commerce and industry of the city. He next discussed the relationship of the Corporation to the Company, and urged that all matters relating to the gas supply should be in the charge of a Committee of the Corporation. In his opinion, the Standing Committee—the Lighting Committee as heretofore—was the one properly qualified and entitled to carry out that work.

Mr. BUCKLEY supported the motion.

Alderman GILL said he considered the most important matter connected with the debate was that which concerned him personally and the other Directors of the Company—viz., the question of the testing of the gas. A great deal had been said about the testings made and the instrument used by Professor Tichborne; and, with all the abuse it had received, he contended that it was fairly reliable. In one respect, no doubt, the testings by the Board of Trade Examiner were tolerably uniform. It was a physical impossibility to make gas always of identically the same illuminating power, so far as decimals went. The Inspector of Public Lighting had been testing the gas in the months of September and October and since then; and what had happened? He (Alderman Gill) was a member of the Works Committee of the Company. He saw by the books and stock what was being used; and he knew that the same materials and exactly the same appliances had been employed for the manufacture of the gas since October as before. Yet the Inspector of Public Lighting for the last two or three weeks had published tests showing 12-candle power and some decimals; whereas with the same instruments in September and October, he published tests giving about 15-candle power. He (Alderman Gill) contended that some explanation ought to be given of this strange variation in the tests—of this sudden fall from 15·6 or 16·2 to 12 candles.

Alderman MULLIGAN: He only records what the instrument does.

Alderman GILL said he did not think the public were so stupid as to be deceived by this. They had no confidence in these tests made in secret, and without any way of knowing what was the quality of the

candles used for comparing the tests. It was according to Act of Parliament that the Gas Examiner should be a competent and impartial person; and he would ask the public to decide whether Mr. Thomas Cotton was impartial. He was paid £150 as Gas Examiner; and he should please his masters—the secret Gas Committee—in order to be kept in his position.

Alderman MEADE said he would put it to Alderman Gill whether he was exercising good taste, as a Director of the Company, in attacking the Gas Committee through their officer.

Alderman GILL said he did not accuse the Gas Committee; but he thought he had a perfect right to speak as to what he considered to be the partiality of their officer.

The TOWN CLERK, at the request of the Lord Mayor, then read a report from Mr. T. Hughes, Gas Examiner to the Cardiff Corporation, as to tests made by him of the illuminating power of the gas at the Corporation testing-stations at Tara Street and at Lower Sackville Street. He stated that at Tara Street, the photometer is a Letheby's open 60-inch, stamped by the Board of Trade; and the instrument is generally in excellent working order. At Lower Sackville Street, an improved Evans enclosed 100-inch photometer, with moveable disc and fixed candles, is in use. This apparatus is also stamped by the Board of Trade, and is of the highest efficiency. He was quite satisfied with the working of both instruments. The average result of the testings ranged from 12·36 to 12·28 candles at Tara Street. At Lower Sackville Street, the average varied from 12·99 to 14·04 candles; the highest result being practically 2 candles below the standard. He considered the old Evans photometer to be an unsatisfactory instrument. It was impossible that the candles could be moved backwards and forwards on a photometer without causing a sensible flickering or other derangement in their normal rate of burning.

The LORD MAYOR said they ought to be satisfied that it was not Mr. Cotton's fault if the instruments did not register correctly. He would recommend them to appoint an independent Committee to solve the problem which these figures presented.

Alderman GILL denied that there was a difference between the quality of the gas supplied to the north and the south sides of the city. The gas left the Company's works by one large main, which branched off north and south.

Alderman MEADE then proposed, as an amendment, that the Council should nominate a Committee consisting of the Electric Lighting Committee and a member from each ward not now represented on the Committee.

After some discussion,

The LORD MAYOR expressed his willingness to withdraw his motion in favour of the amendment.

The amendment was, however, declared to be out of order. Various propositions were then brought forward; and eventually the further consideration of the Committee's report was adjourned to a special meeting to be convened by the Lord Mayor.

MANCHESTER CORPORATION GAS SUPPLY.

The Gas Committee's Reply to Mr. Southern's "Memorandum."

In the JOURNAL last week, we gave an outline of the reply of the Gas Committee of the Manchester Corporation on the subject of the "Memorandum" issued towards the close of the past year by Mr. J. W. Southern, on the working of the gas undertaking, and published in our columns on Dec. 12 (p. 1092). The following is the full text of the Gas Committee's statement, signed by the Chairman (Mr. J. Brooks) and the Deputy-Chairman (Mr. R. Gibson):—

Mr. Southern begins his "Memorandum" by stating: "Rather more than twelve months ago, I called the attention of the Chairman of the Manchester Corporation Gas Committee to the very unsatisfactory position of the undertaking. . . I suggested the means by which Manchester might be placed in a more creditable position." Mr. Southern's letter to the Chairman is dated Oct. 19, 1891; and in that MSS. copy, there is not a single suggestion from beginning to end. In the copy handed by Mr. Southern to the newspapers, however, there appears the following paragraph, which perhaps may be considered a suggestion: "The conclusion to be drawn from these figures is that a duly qualified adviser is wanted."

In reply to this, it may be said: The Gas Committee have an experienced Manager at each of their works; and the one most recently appointed is an able Gas Engineer, with whom the Committee received the highest testimonials. The Committee have also from time to time called in the services of the most eminent and practical gas engineers of the present day; and they, in conjunction with their own Engineers and Managers, have given advice and made suggestions as to the best methods of carrying out important extensions in the manufacture, purification, storeage, and distribution of gas. For these purposes, Parliament has given borrowing powers to the amount of £500,000 to be expended during the next ten years, and about one-half of this is now in course of being spent, the details of which have already been laid before, and received the approval of, the City Council. Further, Mr. Southern says: "Little, if anything, has been done to secure better results." Mr. Southern cannot have recently visited any of the Manchester Gas-Works, or he would have seen that much has been done during the last few years; that great works are now in progress; and that important extensions and valuable additions to plant and machinery have been made since he ceased to be a member of the Gas Committee.

Mr. Southern makes a statement, and shows figures which he says "are taken from Field's 'Analysis.' They are authentic, and may be considered reliable. They have been carefully checked." If that is so, it seems strange that such serious errors in quotation have been made to the disadvantage of Manchester, as the following tables will show. Col. 1 is a correct quotation from Field's "Analysis" of the fixed price charged; col. 2 gives the figures set forth in Mr. Southern's pamphlet; col. 3 shows the *average* price received for gas in the towns named (corrected); and col. 4, the illuminating power of the gas:—

	(1)	(2)	(3)	(4)
Birmingham (average)	2s. 4d.	2s. 2d.	2s. 4·00d.	17·22
Bolton	2 8*	2 8	2 8·47	17·91
Leicester	2 4*	2 3	2 3·88	17·01
Manchester	2 6*	2 7	2 7·22	19·55
Nottingham	2 4 / 2 6	2 5	2 5·66	18·25
Oldham	2 1* / 2 8	2 2	2 4·68	19·69
Salford	2 4*	2 4	2 4·65	18·78

* Higher price charged outside City or Borough boundaries.

Note.—The average price received per 1000 cubic feet sold at Birmingham is given as 2s. 2·70d. A sum equivalent to about 1·30d. per 1000 cubic feet was given in discount for early payment; and, for purposes of comparison, this should not be deducted from the price charged.

In the case of Oldham, it is pointed out in Field's "Analysis" that the sum of £6637 for gas supplied to public lamps is excluded; but Mr. Field has divided the rental by the total quantity of gas consumed. For purposes of comparison, the average price should be based on the quantity charged for; giving 2s. 4·68d. per 1000 cubic feet sold, and not 2s. 2d. as Mr. Southern states.

The statement which Mr. Southern quotes as to capital employed is correct. The favourable condition in which Manchester is placed is mainly owing to the large amounts which have been set aside for sinking fund, as provided for in several Acts of Parliament, and have been written off for depreciation of works and mains. From 1862 to 1892 inclusive, the sum of £737,920 has been placed to the sinking fund; and the sum of £721,435 has also been written off for depreciation. During the same period, the sum of £1,377,355, including the cost of street lighting for 1879 to 1892, has been paid over in reduction of rates. These amounts have been taken out of *profits*.

The following comparative table is instructive on this subject, as showing the difference between the sums paid off by Manchester and the towns quoted by Mr. Southern:—

Town.	Capital Authorized.	Capital Employed.	Sinking Fund Applied in Substitution of Loans and Annuities.		Capital on which Interest is Paid.
			Amount.	Per Cent. on Capital Employed.	
	£	£	£	£	£
Birmingham	2,520,193	2,324,998	318,964	13·72	2,006,034
Bolton	663,506	552,952	5,146	0·93	547,806
Leicester	771,732	771,732	Nil.	Nil.	771,732
Manchester	1,370,000	1,370,000	688,418	50·25	681,582
Nottingham	932,450*	932,450	28,031	3·00	904,419
Oldham	610,304	485,154	53,470	11·02	431,684
Salford	608,524	608,524	147,350	24·21	461,174
Average of six Corporations				9·74	
,, Manchester				50·25	

* No limit.

Manchester paid to the sinking fund £14,342 per annum from 1844 to 1892, against an average of £3522 paid by the six Corporations.

In view of the possibilities of the electric light or other contingencies, the policy which has brought about this result has been a wise one, and does not prove "that the property has been depreciated too heavily," or "that the expenditure on renewals and improved plant has been unduly curtailed," but, according to Mr. Southern's own admission, has placed the undertaking "on a favourable footing for economic working."

Residuals.—Mr. Southern says: "It is in dealing with the residuals that the management of the Manchester Gas-Works is most susceptible of improvement." The following table is an accurate extract from Field's "Analysis;" showing the amount received for residuals per ton of coal carbonized:—

	Coke.	Tar.	Liquor.	Total.
Birmingham	2s. 10·70d.	1s. 0·01d.	1s. 2·03d.	5s. 0·74d.
Bolton	2 4·88	2 1·73	1 6·78	6 1·39
Leicester	3 7·82	1 3·95	1 3·67	6 3·44
Manchester	2 3·20	1 10·85	1 3·96	5 6·01
Nottingham	3 1·18	2 1·44	1 5·94	6 8·56
Oldham	1 10·40	2 1·63	1 2·00	5 2·03
Salford	2 5·35	1 5·91	1 1·88	5 1·14
Six Corporations (average)	2 9·86	1 5·31	1 3·11	5 6·28
Manchester	2 3·20	1 10·85	1 3·96	5 6·01

In going through the accounts of gas-works, it will be noticed that, depending upon favourable or unfavourable contracts made, each town in turn has periodically a good market and an indifferent one. Take Bolton, for example. Their receipts for residual products in 1892 were 6s. 1·39d. per ton; but for the year ending March, 1893, they had fallen to 4s. 10·1d.—being 1s. 3·29d. per ton less, or 20·84 per cent.

Manufacture of Sulphate of Ammonia.—In order to increase the profit to be obtained from ammoniacal liquor, it is sometimes advocated that the Committee shall themselves work up the liquor into sulphate of ammonia. Hitherto the City Council have set their faces against this plan being adopted, on the ground that it would be a new business, outside the scope of their duties, and an interference with private enterprise. The contract is entered into after public competition; and the price paid by the contractor is ruled by the price of sulphate of ammonia. By the system advocated, a loss might be the result in some states of the sulphate market. Of the towns named by Mr. Southern, Bolton, Leicester, Nottingham, and Salford manufacture their liquor into sulphate of ammonia. Yet the results are not so much in its favour as appears from Mr. Southern's paper. In fact, if Salford had been able to sell their liquor in 1892 at Manchester prices, they would have received more for crude liquor than they actually received for sulphate. (N.B.—In the year 1890, the Manchester make

was only 23·2 gallons of 10-oz. liquor per ton; and in 1892, 24·54 gallons. Last year showed a further rise to 25·35 gallons.)

Coke.—It is well known that methods of charge differ in different towns; and it is doubtful as to whether the value of coke used in the works and the expenses charged to coke in the accounts referred to are dealt with in all cases alike; and unless it can be shown that this is so, no just comparison can possibly be made. The geographical position of a town, and other local circumstances, have much to do with the price obtained for coke. The best possible price is obtained for the Manchester coke. There is no great demand for it at any time, except during a scarcity of coal; and a very slight advance in price will check the sale, cause stocks to accumulate, and expense and waste to arise. The quantity of coke obtained in Manchester from a ton of coal carbonized is 12·77 cwt. The average production in the towns named by Mr. Southern is 12·43 cwt.; ranging from 11·87 cwt. at Nottingham to 13 cwt. at Oldham.

Tar.—For the purchase of tar, tenders are obtained by public advertisement; and invariably the highest price is accepted. The quantity of tar produced in Manchester per ton of coal carbonized is 13·1 gallons. The average of the six towns named by Mr. Southern is 11·75 gallons; ranging from 10·6 to 13·7 gallons.

Purchase of Coal and Cannel.—The Gas Committee purchase coal and cannel in response to public advertisement; and all coal or cannel offered is subjected to severe and repeated tests, and the productive value calculated on a common basis. The offers show the best results are invariably purchased. Materials being received under contract are also tested, and by this means kept up to purchase quality.

Sale of Bye-Products.—Offers for the purchase of tar and liquor are also only received in response to public advertisement, and the highest price is accepted.

Mr. Southern makes some insinuations as to the commercial and administrative ability of the Gas Committee and their officials. In page 6 of his pamphlet, he again suggests his only remedy, and concludes thus: "If these are facts, and I believe they are, then I conclude that it is the duty of the Gas Committee to call in the advice of a fully qualified scientific man to point out the defects in their working and administration, and the changes necessary to place Manchester where it ought to be—in the foremost place, and not as it now is in the hindmost, in this most important department of Corporation enterprise." An examination of the figures quoted by Mr. Southern himself, and such a statement of facts as will enable a *fair* comparison to be made, may show that, if the Manchester gas undertaking is not already in the "foremost place," it certainly is not "in the hindmost, in this most important department of Corporation enterprise."

Price of Gas.—In dealing with the price of gas, Mr. Southern states that the Manchester charge is the highest in the list, with the single exception of Bolton. In order to arrive at a just comparison, it is necessary to make allowance for the better quality of article supplied. With that object, all the figures are here reduced to the Manchester standard—viz., 19·55 candles—with the following results as to comparative value:—

	Received per 1000 Feet Sold.	Relative Value.	Increased Cost per 1000 Feet Required to bring Gas to Manchester Standard.
Birmingham	2s. 4·00d.	2s. 3·50d.	3·72d.
Bolton	2 8·47	2 4·60	2·62
Leicester	2 3·88	2 3·16	4·06
Manchester	2 7·22	2 7·22	—
Nottingham	2 5·66	2 5·14	2·08
Oldham	2 4·68	2 3·94	3·28
Salford	2 4·65	2 6·00	1·22

So far, then, the price charged in Manchester appears to be fair and reasonable, in return for which consumers are supplied with an illuminant cheaper, in relation to comparative value, than are those of the towns named by Mr. Southern.

Make of Gas.—The figures given by Mr. Southern as to make of gas are accurately taken from Field's "Analysis;" but, as they stand in his report, they cannot be considered fair results for comment. They must be reduced to a common basis of 20 candles:—

	Make per Ton. Cub. Ft.	Illum. Power. Candles.	20-Candle Make. Cub. Ft.
Birmingham	9,319	17·22	8023
Bolton	9,826	17·91	8799
Leicester	10,436	17·01	8875
Manchester	9,684	19·55	9466
Nottingham	10,451	18·25	9536
Oldham	10,204	(19·69) (17·50)	8928
Salford	10,223	18·78	9599
Six Corporations (average)	9,820	17·55	8617
Manchester	9,684	19·55	9466

Mr. Southern says: "It may fairly be said that, in a well-conducted gas-works, there should be a production of 10,000 cubic feet per ton;" but he does not say of what illuminating power. He refers to the make per ton at Brighton and Plymouth, where a little over 11,000 cubic feet are produced; but he does not say that the gas supplied is only slightly over 14 candles. Brighton and Plymouth gas consumers would, therefore, have to burn 40 per cent. more gas to obtain the same light as Manchester consumers. As to the percentage of cannel used in Manchester as compared with other towns named, no reliable comparison can be made unless we know what description of cannel is used and the price paid, and what charges are debited thereto. The cannels which produce the best results are, of course, high in price; but where these are used, a much greater proportion of coal may be carbonized to obtain the desired results as to quantity of gas, illuminating power, &c. Much of the cannel at present employed in Manchester is purchased at a price little higher than coal; and while producing seconds coke only, it yielded more and better gas than coal.

Cost of Coal and Cannel.—Mr. Southern says: "If by buying as well, extracting as completely the residuals contained in the coal, and turning them into money instead of leaving them as impurities in the gas, or wasting them in the process of manufacture, Manchester could reduce the cost of its coal, less the receipts from residuals, to the same level as Nottingham, it would make a money difference to the advantage of Manchester of no less than £61,425 per annum; if to the level of Leicester, a difference of £36,562 per annum." This is not a fair comparison; Manchester gas being 1·3 candles better than Nottingham, and 2·54 candles superior to Leicester. The excess power does not appear very great; but it is extremely costly to produce and maintain. Mr. Southern, however, admits that it is hardly fair to compare Manchester with the Midland town, because of the higher price paid for coke. He says: "There can be no unfairness in comparing Manchester with Bolton and Salford. If Manchester did as well as Bolton, it would save £32,175 per annum; or if so well as Salford, £17,550." Dealing with Salford first, they received 4·87d. per ton less for residuals than Manchester did—amounting to about £7100 on our total carbonization. As regards the rest of his statement, it is sufficient to say that Manchester produces a gas superior to that made by Salford. With respect to Bolton, they had exceptional prices for their residuals during the year quoted by Mr. Southern, and which have not been maintained. As already stated, their last account shows a decline of 20·84 per cent.; and again it must be stated, their gas is inferior to ours.

The following statement shows the cost of gas, including coal, cannel, &c., and working charges during the years named:—

	1882.		1887.		1892.
Gross cost per 1000 feet.	3s. 2·70d.	..	2s. 11·54d.	..	2s. 10·43d.
Less received for—					
Coke	2·30d.	2·28d.	2·98d.		
Tar	3·39	1·71	2·50		
Liquor	4·02	1·31	1·75		
Sundries	1·52	1·69	2·01		
	0 11·23		0 6·99		0 9·24
Net cost	2 3·47	..	2 4·55	..	2 1·19
Price of gas	2s. 10d. & 2s. 8d.	..	2s. 8d.	..	2s. 6d.

It will be seen that a serious reduction has taken place in the value of tar and liquor; and although during the same period the cost of labour and material has greatly increased, the net cost of producing gas has been, by good management, considerably reduced.

Mr. Southern's Summing Up.—The following is a full extract from Mr. Southern's paper: "To sum up, Manchester pays for its raw material 1s. 5¾d. per 1000 feet of gas sold, against an average for the six Corporations named of 1s. 3¼d. It receives for its residual products 5s. 6d. for every ton of coal carbonized, against an average for the six towns of 5s. 6¼d." (incorrectly stated by Mr. Southern to be 5s. 8d.). "It has to bear a charge for interest on capital of less than 2d. per 1000 feet, against an average of about 5¼d." This should be carried a little further, and a net result shown. The exact figures give the following results: Manchester pays 1s. 5·78d. per 1000 feet sold for raw material producing 19·55-candle gas, against six Corporations paying 1s. 3·26d. per 1000 feet sold for material yielding 17·55-candle gas. Manchester received 7·33d. per 1000 feet sold for residuals, against 7·22d. by other Corporations; and paid interest equalling 1·89d., against 5·58d. per 1000 feet sold. The net result is as follows:—

	Manchester.		Six Corpns. Aver.
Paid for coal	17·78d.	..	15·26d.
Paid for interest	1·89	..	5·58
	19·67	..	20·84
Less received for residuals	7·33	..	7·22
Cost of material and interest, less residuals, per 1000 feet sold	12·34	..	13·62

Net Profit.—In dealing with net profit, it is not right to accept the figures as they stand, although Manchester occupies the highest position in the list. The following figures appear in Field's "Analysis."

	Profit per 1000 Sold.
Birmingham	1·91d.
Bolton	5·81
Leicester	5·82
Manchester	5·97
Nottingham	4·98
Oldham	2·07
Salford	3·76

It is Mr. Southern's contention that we should make more profit. During the year under review, the Manchester public lamp capital, amounting to £9085, was written off; and Manchester paid to the sinking fund £5532 in excess of the average amount paid by the other Corporations. Thus had each town been on an equal footing, the sum of £14,617 would have been available for relief of rates in Manchester in addition to the amount of £55,596 actually paid over. Then, again, £20,393 were expended on extraordinary renewals of plant, &c., amounting to 1·55d. per 1000 feet sold [Note (*a*) Wear and Tear, Field's "Analysis"]; and the sum of £9597 was placed to renewals account reserve fund. This latter item, however, has not been taken credit for, as in a few cases a similar charge is made against profits by some of the other towns named.

Net Result.—Summed up, the following is the net result:—

	Six Corporations.		Manchester.
Net profit	2·74d.	..	5·97d.
Excess interest over Manchester	3·69	Exceptional charge for renewals	1·55
	6·43d.	..	7·52d.

The conclusion of the whole matter is that, without taking into account any merely local differences in position and circumstances, and reducing the tables furnished or referred to by Mr. Southern himself to one common level, if the six Corporations and Manchester had been working on an equal basis, the Corporations would have made only 6·43d. profit against Manchester 7·52d. per 1000 feet sold; leaving a difference of 1·09d. per 1000, which, on the total quantity of gas sold during the year quoted by Mr. Southern, amounts to £14,357 in favour of Manchester.

It was expected that the foregoing report would be discussed at the meeting of the Council last Wednerday; but the matter was not reached, and it now stands over for a fortnight.

THE PUBLIC LIGHTING OF BIRMINGHAM.

An article on the "Lighting of the Street-Lamps" appeared yesterday week in the *Birmingham Post;* and it is of sufficient interest to justify us in giving the following abridgment:—

The first proposal to use gas in lighting the streets of Birmingham was made in July, 1811; and here and there a lamp soon appeared, though they were supplied by private firms. The Street Commissioners did not take up the matter till 1815; and in November of that year, they advertised for tenders for lighting the streets with gas instead of oil. The principal streets were first officially lighted by gas-lamps on April 29, 1826; but it was March, 1843, before the Town Council resolved that that part of the borough within the parish of Edgbaston should be similarly illuminated. Most of the public lamps at that period were affixed by an arm or bracket to a house or wall. There were no ornamental columns or triple lights, which are such ornaments to our streets now. The suitability of gas for lighting purposes very soon brought numerous companies for supplying it into existence. In the year 1817 the first Birmingham Gaslight Company was formed, and soon afterwards commenced business by buying up the works of a private owner in Gas Street. The operations of the Company were limited to the borough of Birmingham; but in 1825 the Birmingham and Staffordshire Gas Company was established, and had power to lay their mains in and outside the borough. In view of the recent increase in the price of gas, it may be stated that in 1839 the two Companies (between whom there was no rivalry, competition not having been thought of) charged 10s. per 1000 cubic feet; while in 1873, before the purchase of these undertakings by the Corporation, the price was 2s. 3d. to large consumers—the highest charge being 2s. 7d. Both Companies were purchased by the Corporation in 1875. As early as 1864, however, the Corporation took over the public lighting; and the amount of gas consumed was then approximately ascertained by the average meter system. At that time the lighting was very irregularly done, some of the lamps in out-of-the-way quarters of the town went for days without being extinguished, and for weeks together without being cleaned. Now, however, the street lighting has become almost a science, the men work with the regularity of clockwork; and, in about sixty-five minutes from the time of starting, the whole of the lamps in the city are lighted.

For lighting purposes, the city is divided into three parts, with headquarters in Park Street, Lancaster Street, and Sheepcote Street. The extension of the city boundaries added 1100 lamps to the number to be lighted; making the total, including 1680 in courts, 10,610. All these lamps are in the city, and are lighted and extinguished each day by 100 men, who are employed for the purpose by the Public Works Committee. At the time the Corporation took over the street lighting, there were 3800 lamps and 38 lighters. It will thus be seen that the number of lights has more than trebled in the thirty years; while the number of hands employed has only a little more than doubled. The time for lighting and extinguishing the street-lamps is regulated by the time of the sunrise and sunset as stated in "Whitaker's Almanac," except in very dark or foggy weather, when the work is begun earlier, and the men are then expected to report themselves earlier. The earliest time for commencing to turn out the lights is 1.15 a.m. and the latest 6.25 a.m.; while the earliest hour for beginning lighting is 3.15 p.m., and the latest 8.30 p.m. In the winter months, the street-lamps are burning for upwards of fifteen hours a day. In a few of the principal streets in the centre of the city, two of the three burners in the large lamps are "checked" or turned off about midnight each night. In 1864 the largest burners in use in the street-lamps consumed 5 cubic feet of gas per hour; but some of the duplex and triplex burners now used consume 35 cubic feet per hour. All the burners are graduated between 3 feet and 30 feet per hour, except at specially dangerous crossings, where the pressure is greater. The average meter system, which was in vogue at the time the Corporation took over the public lighting, is still used, though it has been modified, and there is one meter to every fifty lamps, instead of one in twelve, as formerly. These meters are examined quarterly; and the Gas Department charge the Public Works Committee for the gas consumed in the lamps at the rate of 1s. 2½d. per 1000 cubic feet, less 5 per cent. for prompt payment. Until the recent advance in the price of gas, the charge to the Public Works Committee was at the rate of 1s. 1⅞d. per 1000 cubic feet. The total annual consumption of gas in the street-lamps is about 130 million cubic feet; and the cost last year was £5630. Besides this, a large quantity of oil is used by the men in the torches; and no fewer than 18,720 boxes of matches per annum, or at the rate of two-and-a-half gross boxes per week. Each man lights and extinguishes 110 lamps per day; and this work, the lamplighters state, means about 12 miles walking. Last year the street-lamps were burning for 3704 hours 15 minutes. In the summer months, the whole of the lamps are taken to one or other of the depôts for repainting; about four months being required to complete this work.

Besides the Superintendent (Mr. W. Green), there is an Assistant Superintendent and four Inspectors, whose duty it is to see that the lighting is punctually done, and the lamps regularly cleaned. The lamplighters' wages are 22s.; and their hours about forty-eight per week. They are also allowed one day's holiday each month—a concession which Mr. Allan Granger obtained for them three years ago. All the lamplighters are members of the City Lampmen's Union, which was formed in 1875. The Public Works Committee offer no objection to the men engaging in other work when they have finished their lighting, extinguishing, and cleaning. But they do insist upon having this well and promptly done; and the men pride themselves upon being able to satisfy the Committee's requirements.

The Pretended Meter Inspector.—At the North London Police Court last Tuesday, Walter Coley, described as a clerk, was charged on remand with falsely representing himself to be an inspector of The Gaslight and Coke Company. The previous proceedings have been already reported (see *ante*. pp. 112, 155). Mr. Humphreys prosecuted; and the evidence having been completed, the prisoner was committed to the London Sessions for trial on seven charges of obtaining money by false pretences and stealing property.

THE LIGHTING OF BLACKPOOL.

Extension of the Electric Lighting Plant and of the Gas-Works.

Considerable discussion took place at the meeting of the Blackpool Town Council last Tuesday with reference to schemes which were submitted for the extension of the electric lighting works and of the gas-works. The Electric Lighting Committee recommended that application should be made to the Local Government Board for power to borrow £24,000, repayable in 30 years, for the extension of their plant and works.

Mr. PEARSON, the Chairman of the Committee, explained that they had spent £4000 in excess of the previous loan of £26,000. Part of this extra expenditure was on meters, cables, &c., which were in stock; and they had also purchased a more expensive pillar than was at first estimated for. They contemplated immediate extensions which would cost £15,000. There had been a great augmentation in the consumption; and, as the result, the cost of production had decreased. The Committee calculated that in time the revenue would so increase that they would be able to supply the electric light at 3d. per Board of Trade unit. They proposed to add to the machinery to the extent of 500-horse power. Altogether, the development of the undertaking and the results achieved had far surpassed the Committee's expectations.

Mr. BICKERSTAFFE opposed the action of the Committee, and said that, for one, he was not going to be led away by what appeared on the surface to be a very favourable state of things, but which was not found to be so on analysis. When they were asked to sanction the borrowing of £26,000, they were given to understand that this amount would meet all requirements. It was not true that the electric light was a paying concern. On the contrary, there was a loss of £216 on the first four months' working; and there was no provision for sinking fund or interest on the outlay. At present they had to provide for £1600 a year for interest and sinking fund; and if they borrowed an extra £24,000, they would have to raise about £3000. The present charge for electric lighting in Blackpool was 4½d. per unit; and Mr. Pearson talked of reducing it to 3d. But in London and other large towns, the charge was 6d. He did not see how they were going to sell it at anything like the price; and, though he did not say that Mr. Pearson wilfully misled them, such statements were calculated to mislead the public.

In the course of subsequent discussion, the opponents of the scheme urged that it was desirable to try the present works for twelve months before carrying out extensions; while, on the other hand, it was contended that the need was pressing, and delay dangerous.

Mr. PEARSON, in reply, said it was true that nothing had been set aside for sinking fund or interest, but nothing was required until the 25th of March. Nobody expected that the works would pay from the beginning. But they could not supply the demand without the proposed extensions; and if the Committee were allowed a couple of years' work, they would show an appreciable profit. When it was agreed to borrow the original £26,000, no member of the Committee thought the works would be so successful as they had proved to be.

Twelve members supported the recommendation of the Committee, while seven voted against. It was therefore agreed to make application for the proposed loan.

With regard to the gas-works, the Markets and Gas Committee recommended that application should be made to the Local Government Board for sanction to a loan of £45,000 for extensions; the money to be repaid in 50 years.

Alderman PARKINSON, the Chairman of the Committee, in answer to some inquiries as to the necessity of the expenditure, explained that the consumption of gas had overtaken the present means of supply, and that, among other things, an additional gasholder would have to be erected.

The Council approved of the application.

BURY CORPORATION GAS SUPPLY.

The Differential Rate.

In accordance with the promise made at a previous meeting, Mr. T. Holt called attention at the last meeting of the Bury Town Council to the question of the difference in the price charged for gas as between consumers within the old limits of the borough and those in the added area. The Gas Committee, in advancing the price of gas, recently decided that the increase should be 4d. per 1000 cubic feet in the old borough, and 6d. in the added area and the outside district; raising the differential rate to 11d. per 1000 cubic feet. Mr. Holt now invited the Council to declare that this difference of 2d. was, as regards the added area, excessive, and to instruct the Gas Committee to reduce the differential rate by this amount as from the 1st of January last. In support of his proposition, he argued that the old borough had practically no liability in respect to the gas undertaking which was not shared by the added area; and he said that, although there was a possibility of explosions and similar catastrophes, these were very rare, and could scarcely be taken into account. It was not a fact that the outside consumers did not bear a share of the loss sustained last year; for they contributed to, and helped to replenish, the very fund from which the losses were met. There was also very little in the argument as to extra cost of collecting the accounts, because most consumers paid their bills in order to get the extra discount. Inquiries had elicited the fact that other towns dealt less hardly with the outside districts. At Bolton no extra charge was made to the consumers within a two-mile radius. Even outside this limit, there was no extra charge to consumers of 250,000 cubic feet and upwards; while to small consumers the extra charge was 6d. per 1000 cubic feet. The two-mile radius would cover the added area within a very little. Warrington charged 6d. extra to consumers who were a mile outside the borough; Rochdale charged 5d.; and Burnley, 10d. At Oldham and Heywood, the charges were the same inside and outside the borough. Bury had been harder than these places on the outside districts; and the price

had now been raised to the straining-point, and the result must be a reduction in the consumption. Mr. Wike, who seconded the motion, contended that the gas undertaking should not make excessive profits; and that people who did not consume gas were not entitled to benefit by the profit made from the works. They were all agreed that it must cost more to supply gas to the added area; and all the people in that district wanted was that they should not have to pay an excessive amount. Mr. Byrom, Chairman of the Gas Committee, in justification of the course which had been pursued, pointed out that the revenue which would result from the increased price decided upon would be about £500 less than the amount of the loss incurred by the coal strike. If, instead of raising the price 4d. inside the borough and 6d. outside, they had made a uniform increase of 5d. per 1000 cubic feet, there would have been a sum in excess of the amount lost, and the people of the added area would have shared in the profit. In Mr. Holt's calculation, nothing was allowed for the risks which the Committee ran, and the liabilities incurred. So far as the added district was concerned, the Gas Committee were a trading concern; and they were entitled to a reasonable profit. An attempt to secure postponement of the question, in order that the figures might be further considered, was defeated. Alderman Brierley and one or two other speakers having declared that the Gas Committee were willing to take the added district into partnership on equal terms with the rest of the borough, the Council divided; and Mr. Holt's motion was rejected by 28 votes to 5.

THE TRANSPORT OF PETROLEUM IN BULK.

At the Meeting of the Institution of Civil Engineers last Tuesday, a paper on the above subject, considered from the point of view of minimizing the risks of fire and explosion, was read by Mr. Boverton Redwood, F.R.S.E., Assoc.Inst.C.E.

Beginning with the question of accidents arising from transport in bulk, the author stated that the few, but unfortunately serious, disasters which had attended the general adoption of the system of transporting petroleum in bulk in tank steamships had been collectively of a most instructive character, and that there was much to be gained by a critical consideration of the conditions under which they arose. Before, however, proceeding to review these, he referred to some cases of accident not connected with this mode of transport, or in which other volatile inflammable liquids had been implicated. Details were furnished of the principal accidents which have taken place in connection with the transport of petroleum in bulk. In the case of the *Petriana*, it was shown that there was no audible explosion, but a silent ignition of oil which had escaped in a state of spray into an empty compartment. In the instances of the *Ville de Calais*, *Fergusons*, *Tancarville*, and *Petrolea*, there was in each case a violent explosion. The loss of the *Lux* was primarily due to the ignition of oil which had gained access to the boiler space. With the exception of the first and last, these vessels carried crude petroleum; while in the two exceptional cases, the cargo consisted of refined petroleum (kerosene).

The formation and ignition of inflammable and explosive mixtures of petroleum vapour and air were next considered; the author stating that certain descriptions of petroleum evaporate freely at common temperatures; that the vapour given off is much heavier than air, and may remain for a considerable length of time in any receptacle capable of holding a liquid, or flow unperceived for some distance in a stream similar to that of a liquid; that the vapour is highly inflammable, and capable of carrying back flame to the source whence it emanated; and that mixtures of petroleum vapour and air may be either inflammable (burning silently) or more or less violently explosive. It was further shown that petroleum, at temperatures below that at which vapour is freely evolved, may be converted into a highly combustible spray. Crude petroleum consists of a great number of hydrocarbons, some of which are exceedingly volatile; and the vapour given off may be from 2½ to 3½ times heavier than air—its density depending upon the chemical composition of the hydrocarbons present. From the vapour density, the volume of vapour given may be calculated; and it is thus found that one volume of a petroleum spirit consisting principally of hexane yields 187 volumes of vapour at 60° Fahr. The percentage volume of the vapour of a volatile hydrocarbon taken up by air depends upon the tension of the vapour, and varies with the temperature. When the vapour of petroleum is brought into contact with air, diffusion takes place; the heavy vapour travelling upwards into the lighter air, and the air passing downwards into the vapour. The weight of a volatile liquid hydrocarbon which will pass into a given volume of air (up to the point of saturation) is the same as that which will volatilize into an equal vacuous space, though the evaporation into air takes place far more slowly than into a vacuum; and when the air becomes saturated with vapour, the tension of the mixture is the sum of the tensions of the air and vapour separately. Therefore when petroleum spirit or crude petroleum is evaporating in a partially filled tank, a large increase in the volume of the atmosphere above the liquid in the tank takes place.

The proportions of vapour and air requisite for the production of inflammable and explosive mixtures were experimentally determined with apparatus described; and the data obtained were set forth in the paper. The general principles governing the manner in which these mixtures behave on ignition were also discussed. Briefly, it was found that, when a volatile hydrocarbon was evaporating into air in a confined space, the atmosphere first became inflammable (burning silently); then more and more explosive up to a certain point; then less and less explosive; and, finally, if sufficient hydrocarbon were present in the atmosphere, only combustible when in contact with the outer air. The conditions under which an explosive mixture of petroleum vapour and air might be ignited were investigated; and it was stated that it was impossible for the glowing end of an ordinary wooden match or of a "fixed star" vesuvian the flame of which had been extinguished, or a red hot coal which had ceased to blaze, or a shower of sparks from a flint and steel or from the fireworks known as "scintillettes" and "golden rain," to cause the combustion of the mixture. A platinum wire, however, raised to white heat by means of electricity, invariably caused ignition, though at a red heat no such effect was produced. Either the electric spark or a flame at once caused the explosion of such a mixture; but an inflammable mixture containing a small proportion of vapour might be ignited by a large flame when a small flame or an electric spark proved ineffective for the purpose. The use in an oil-tank of a heated rivet at a temperature below that which was requisite for the ignition of a mixture of petroleum vapour and air might nevertheless be attended with danger, owing to the ignition of the oil which remained between the plates at the laps.

The subject of the construction of petroleum tank steamers was next referred to; and mention was made of papers read before other bodies. There were, however, the author stated, a few points, arising out of the accidents referred to, still undealt with. The importance of extending to the extreme height of the upper deck the coffer-dams separating the oil-tanks from other spaces had now, he said, become recognized; and if there were any doorways in the "'tween-decks," in the bulkheads forming the coffer-dam, adjoining the engine space, they should be fitted with doors which could be screwed up oil-tight. There was now a general concensus of opinion in favour of keeping the coffer-dams full of water while the vessel had her cargo of oil on board. The oil-tanks should be completely isolated from the coffer-dams and other spaces, and should therefore be fitted with a separate service of pipes and pumps. In steamships carrying volatile crude petroleum in bulk, there should be provision for the safe discharge of vapour from the tanks; and tank steamships in general should be fitted with steam-jet or fan ventilating appliances.

The precautions to be observed in the management of tank steamships were next considered. The author stated that, so long as the cargo tanks of a properly constructed tank steamship were full of oil, there was very little risk of fire or explosion, except through serious structural damage resulting from collision or other accident. The accumulation of vapour in the "'tween-deck" bunkers, due to leakage of oil from the expansion trunks of the oil-tanks, must, however, be guarded against; and care must be taken that the expansion trunks did not become overfilled or empty, in consequence of increase or diminution in the volume of the oil. Even in the case of vessels carrying crude petroleum in bulk, there would not be sufficient justification for any attempt to prevent smoking and the use of matches while at sea. But it was desirable that special places should be set apart for smoking, and that only safety matches should be used; both smoking and the use or carrying of matches elsewhere being strictly prohibited. The chief risk occurred during loading and discharging. At such times, therefore, smoking and the use or carrying of matches of any kind anywhere on board, as well as the employment of naked lights and fires (other than the main boiler fires, which should be banked) should be rigorously prohibited. The vessel should, except as regards the necessary marine lights, be lighted only by electric glow lamps; the ship being very carefully wired, the positions of the switch-boards judiciously chosen, and any lamps used in spaces liable to become charged with vapour being of safe construction. The tank-covers should be kept closed as much as possible; and in the case of crude petroleum, provision must be made for the safe discharge of vapour during loading or while water ballast was being taken in. Before the tanks were entered for inspection, they should be ventilated; and if repairs necessitating the use of hot rivets were to be effected, the oil compartments and adjacent spaces should be thoroughly cleansed and efficiently ventilated in the manner described in the paper, until, on testing by a competent expert, the complete removal of inflammable vapour was found to have been accomplished.

The paper concluded with some remarks on testing the atmosphere of tanks and other spaces. The author said this subject had engaged his attention during the past two years and a half; and he gave details of his experiments.

Annual Dinner of the Liverpool Gas-Meter Inspectors.—The meter inspectors employed by the Liverpool Gas Company held their annual dinner on the 1st inst., at the Lisbon Restaurant, under the presidency of Mr. J. Grisenthwaite. An amusing feature of the musical portion of the evening's entertainment was a very clever parody, by Mr. W. Parnham, of "The Bogey Man," under the title of "The Meter Man," with special reference to the introduction of automatic meters. In the course of his remarks, the Chairman stated that these meters had been found by the public and the Company to be a conspicuous success; and they would be still fixed very extensively to meet the persistent demand for them. The cordiality with which the name of Mr. Robinson, the Company's Treasurer, was received, showed clearly how high he is held in the estimation of the subordinate officials.

Reduction in the Price of Gas at Dover.—The Directors of the Dover Gas Company have made an announcement which must have caused much satisfaction in the town—viz., that they have reduced the price of gas to 2s. 6d. net per 1000 cubic feet. As the maximum allowed to the Company is more than twice this amount, the latest concession to the consumers must be taken as further evidence of the Directors' desire to deal liberally with them, and not, as certain members of the Corporation have tried to make out, be attributed to fear of the competition of the electric light. Seeing that the coal strike enhanced the price of their raw material, every ton of which that goes into the works has to bear a charge of 3s. for town and harbour dues and cartage, the fact that a reduction is possible is a proof of Mr. R. Herring's efficient management. His sale of gas per ton of coal carbonized, including the quantity used on the works, is 10,335 cubic feet. As our readers are aware, Mr. Herring uses oil as an enricher; and his last purchase of this material was effected at 3⅝d. per gallon (barrels free), less 2½ per cent. discount, delivered on wharf or rail in London. But as two large oil-stores—one American and the other Russian—have just been opened at Dover, there is every probability of a reduction on these figures. Should this come about, the Company will, of course, profit by it; and the Directors will, no doubt, again take the price of gas into consideration. In the meantime, the Local Authority might help towards a further reduction by turning their attention to lightening the town dues.

THE WELSH WATER SCHEME OF THE BIRMINGHAM CORPORATION.

The Request for a Local Inquiry Refused.

About four hours were spent by the Birmingham City Council last Tuesday in another debate on the Welsh water scheme; but the pressure on our space this week will not permit of more than a short account of the proceedings being given. The report of the Water Committee (of which a summary appeared in these columns last week) was submitted for adoption by the Chairman (Alderman Lawley Parker). In doing this, he made a speech of considerable length—touching first upon the late drought, and then upon the breakdowns in the distributing system during the frost. In this connection, he intimated that the Committee were determined to make arrangements to reduce to a minimum the inconveniences arising from unavoidable accidents at critical times. A brief reference to the progress of the Welsh scheme brought Alderman Parker to the challenge which had been thrown out by Mr. Stembridge in the notice which he had placed on the *agenda*. It ran: "That as the report of the Royal Commission on the present and future water supply of London throws new and important light upon underground water resources, and establishes the perfect efficiency of filtration as a means of purifying water drawn from local streams which may be subject to pollution, this Council is of opinion that, before further expenditure is incurred in connection with the Welsh water scheme, the whole question of Birmingham's future supply should be reviewed by a local commission empowered to call evidence, and to obtain expert estimates as to the amount of water which may be drawn from watercourses and deep wells in the more immediate neighbourhood of the city." Before, however, proceeding to deal with this matter, Alderman Parker alluded to a remarkable letter from Mr. Howard Lane which had appeared that morning in a local paper, and in which most serious imputations were made; and he suggested that Mr. Lane should lay his facts before the Mayor. (Further reference to the letter in question will be found at the end of this summary.) Dealing next with the opposition to the Welsh scheme, the assertion that it would cost the round sum of 10 millions was first disposed of. The real facts, said Alderman Parker, were that the first section of the works, which would supply 26 million gallons of water per day to Birmingham, was estimated to cost £3,621,950. This was the extent to which they were committed; and he reminded the Council that the interest and sinking fund upon that capital expenditure was provided for: First, by the present water charges, and no more; secondly, by the saving in pumping; and, thirdly, by the anticipated increase in the demand. It was quite true that the whole scheme for which they had parliamentary power would, if carried out, cost rather more than 6½ millions; but that scheme it was contemplated would not be completed till sixty years had expired—it would be undertaken by instalments, as needed. There would not be one penny of charge in the form of rates upon the ratepayers; and there would be no higher charges for water than ruled before the voluntary reduction that was made by the Department some years ago. He proceeded to deny the accuracy of a "statement of facts" which had been circulated by Mr. S. Lloyd (a member of the Council). With respect to the rate of increase in demand, the Committee had reckoned it at the rate of 3 per cent. for the first ten years, 2¾ per cent. for the next ten, and so on, taking ¼ per cent. off per annum until they came down to 1½ per cent. Taking the forty years' period within which the Royal Commission on the Metropolitan Water Supply pursued their calculations, the facts were that the London increase of demand was at the rate of about 2 per cent., not 1½; and that of Birmingham was rather more than 2½, and not 3 per cent. In London at the present time, the amount of water consumed per head was higher than in Birmingham; and so they might be expected to increase more than London in this particular. Since the Committee's tables were prepared, and before the drought, the increased demand had actually been 4 per cent., or 1 per cent. more than their calculation. Coming to the bearing which the report of the Royal Commission had upon the scheme, Alderman Parker said the argument appeared to be that, because London could find enough water within its local sources for forty years, Birmingham ought to be able to do the same. There was, however, no analogy. The gathering-ground of London was 4000 square miles; while that of Birmingham was only 111 square miles. Besides this, while the gathering-ground was 36 times larger, the population was only nine times that of Birmingham. It was stated that the idea of London going to Wales was at an end; but the London County Council did not take that view. They considered that forty years was a very short time in the life of a Corporation; and they were applying to Parliament in the coming session for powers to acquire other sources of supply. However, the needs of Birmingham were no less because the needs of London were supplied for forty years. Taking up the question of whether the local sources would give much more water, he referred at length to the evidence given by the geologists when the Corporation Bill was before Parliament; and then passed on to the scheme which was propounded by the Water Engineer (Mr. Gray), and which Mr. Lloyd had again revived. This scheme proposed to impound the waters of the Bourne, at a cost of a million sterling. Mr. Lloyd said that this project would supply the city with water for forty years. It was quite true Mr. Gray hoped there might be enough water to last for twenty years if it were impounded; but he was not aware of the parliamentary practice that always existed of compensation water being provided whenever water was taken from a river over which riparian owners had rights. Therefore, when Mr. Gray became aware of this fact, his evidence showed that, after allowing for compensation, the water impounded would only last four or five years. Assuming they could get 3 million gallons from the present district wells, and the Bourne water was impounded, they would not have enough to last more than ten or twelve years. The opponents also advocated Professor Hull's scheme. This was laid fully before Parliament; but immediately the Professor left the witness chair, the Chairman of the Hybrid Committee said that there was no necessity for the Corporation to call rebutting evidence. Any further expenditure of time and money in holding an amateur local inquiry after the exhaustive parliamentary investigation into the scheme would, Alderman Parker held, be unjustifiable. Mr. Stembridge then moved his amendment, as quoted above. His object in doing this, he said, was simply to have the scheme carefully reviewed; and, notwithstanding the speech of Alderman Parker, he was still under the impression that he had good reason for making his request, in consequence of the recently issued report of the Royal Commission on the Metropolitan Water Supply. He read several extracts from the report; but he did not support his resolution with any fresh arguments adverse to the scheme. He admitted that, if he knew as much of the subject as Alderman Parker, he might perhaps feel more satisfied with the project. The amendment was seconded by Mr. Lloyd, who was certain that nothing short of an inquiry would be satisfactory to the ratepayers. Mr. Beale confessed he could not see the analogy between the facts as brought out before the Royal Commission and the Birmingham position; the only semblance of analogy was that the London people were cautioned not to trust too much to the supply of wells. It was maintained by Mr. Jacobs that the evidence given before the Parliamentary Committee on the Corporation Bill was all one-sided; while Mr. J. Smith was of opinion that, if the amendment was carried, there would be no finality to inquiries. Other members followed—most of them speaking in support of the original motion. In reply to an inquiry as to whether or not it was true £175,000 was the sum to be paid to the Engineer of the scheme (Mr. J. Mansergh), Alderman Parker said the statement was wildly extravagant and untrue. A division was then taken upon the amendment, when six members voted for, and 52 against it; and the motion was afterwards carried.

Regarding Alderman Lawley Parker's reference to a letter by Mr. Howard Lane, this gentleman has since announced that he will accept the suggestion of Alderman Parker to lay before the Mayor (Mr. G. J. Johnson) his evidence in support of the statements contained in the letter. These were as follows: "I now assume the grave responsibility of saying that officials, past and present, in places of trust, would come forward with readiness and prove—(1) That within the knowledge of the Department there is an ample supply of underground water within the immediate neighbourhood of Birmingham. (2) That the financial basis on which the whole Welsh scheme is reared is both inaccurate and unreliable, and is known by the Department to be so. (3) That the statements as to the water supplied in the past and at present from the various pumping-engines is unreliable. (4) That the payments to the witnesses who have supported the promoters of the scheme have been of the most extraordinary nature—£500, £800, and £1100 having been paid to respective individuals for their services, and others in proportion. (5) That the commission to be paid to Mr. Mansergh, the Engineer, who advised the adoption of the scheme, has been kept secret even from members of the Water Committee, but is reported to be the sum of £175,000, free of all expenses, and independent of the extent of the works. (6) Land has been purchased in the most reckless way. Mr. Lewis Lloyd, as an instance, having been offering his estate in the open market for £40,000, received £120,000 from our Water Committee." Some correspondence regarding this matter has passed between Mr. Lane and the Mayor. The former wrote to the effect that he heard with gratification that his challenge to the Water Department had been taken up. He freely accepted the suggestion that his Worship should be a referee; but he must make it a condition that a technical expert should sit by his side. He also distinctly required that the inquiry should be a public and not a private one; or, as an alternative, he offered an investigation before the Judges of the High Court of Justice. The Mayor replied that he was prepared to make an appointment to receive the evidence of Mr. Lane and any witnesses he might choose to bring in support of the six published allegations; but he reserved to himself the right of conducting the inquiry in the way he might think best, and should be prepared to report to the City Council if he considered such a course necessary. With regard to the indemnity to witnesses, he could not give any such indemnity. All he could say was that, if the witnesses told the truth, they had nothing to fear; if the contrary, they must take the consequences. With reference to the allegation that the commission to be paid to Mr. Mansergh had been kept secret even from the members of the Water Committee, the Mayor said he had before him the minutes of the Committee for 1892, at a meeting of which every member, including the then Mayor, was present, showing that the terms were unanimously approved by them. The reasons why it was agreed that the terms should not be published were stated to a subsequent meeting of the City Council, and approved by them. He also had the written agreement with Mr. Mansergh, which showed that the report that he would receive £175,000 was altogether incorrect. A further letter was addressed to the Mayor by Mr. Lane on Friday, from which it appeared that "a public inquiry, the granting of at least six forms of indemnity to witnesses by the Council, and unreserved access to documents," were the only conditions by which he should feel his pledges liquidated. He felt bound to say that the unpleasant discussion had mainly arisen from the systematic suppression of the Water Committee's financial operations from the public. Everywhere there had been secrecy—"unknown but vast commissions to initiators, extravagant payments to complaisant witnesses, and huge bribes to landowners—all tending to raise feelings of demoralization, nay disgust, within every single-minded citizen." He presumed, from the wide divergence of their respective views, some difficulty might be experienced in constituting a tribunal that would be satisfactory to the public; and he intimated that he should be happy to listen to any reasonable modification that might be suggested that would not trench on the principles involved.

Rugeley Water Scheme.—There has been a great deal of delay in proceeding with the new water-works for Rugeley, on account of the Local Government Board not being satisfied as to the yield of water from the proposed source. The Engineer (Mr. Radford) now reports that the testings which have been carried out show that the inhabitants will be able to rely upon a daily supply of 100,000 gallons, which will meet the requirements of the town for many years to come. It is believed this will prove satisfactory to the Local Government Board.

ARTESIAN WELL AND SURFACE WATERS.

At a recent Meeting of the New Jersey Sanitary Association, the following paper, dealing with the above subject from the standpoint of bacteriology and public health, was read by Dr. T. M. CHEESMAN, Instructor in Bacteriology, Columbia College, New York.

All the water found upon the surface or in the crust of the earth has at some time been precipitated from the atmosphere, mostly in the form of rain. It is distributed partly upon the surface of the ground, moistening the soil and coursing in brooks and rivers, or is collected in larger or smaller bodies which form the ponds, lakes, and seas. These waters are collectively termed the surface waters. Another and very considerable portion of the rain percolates the soil and forms the ground water. This water is widely distributed in the crust of the earth, where it runs through fissures in the soil and rocks, and percolates the porous soil. Sometimes meeting with impermeable strata or with channels and cracks in the crust of the earth, it runs or is forced along these, forming the underground streams. Resting in hollows and basins of clay or rock, mixed with deposits of sand and gravel or other earthy matters, it forms the great underground ponds and lakes. Some of the subterranean waters percolate a porous layer of soil, situated between two impermeable strata; the source being from a higher level, so that the water is under pressure. Still deeper in the crust of the earth, other large bodies of water are to be found, formed by the overflow from the ground waters; and these are known as the underground reservoirs.

In its passage through the air, rain gathers many impurities. Various gases are taken up in solution; and solid matters, floating about in the form of dust, are carried to the earth. Again, on the surface of the soil it comes in contact with numerous organic and inorganic substances; so that by the time the water condensed in the clouds has distributed itself upon the surface of the earth, it has taken up many substances in solution and in suspension, and is no longer pure. Mineral substances are usually present in greater or less abundance. When found in small quantities, they generally have no significance; but larger quantities may render water suitable only for special uses, or make it unfit for commercial or domestic purposes.

The organic impurities which may contaminate water are derived from both vegetable and animal sources. Many vegetable impurities undergo decomposition, and are liable to render the water foul. The impurities of animal origin may be excrementitious matters or purifying substances. Both or either of the vegetable or animal contaminations may render the water unpalatable, when present in sufficient quantities, and thus cause it to be discarded for drinking. But although they may be present in such small quantities as not to be appreciated by our unaided senses, yet they may still be able to convey disease, and perhaps cause widespread epidemic. This is especially true in regard to pollution of water with human excrement, even when the pollution is very small in amount, and remote from the source used for the supply of drinking water. The common practice of emptying drains and sewers into the watercourses is fraught with the greatest danger to the public health.

Water polluted by sewage is liable at any time, through receiving the discharges of the sick, to become infected with the germs of one or other of the infectious diseases; and the danger to the public health incurred from drinking such polluted water is that the living germs of disease may with the water gain access to the human body, and through their vital activity induce disease in us. Fortunately for our well-being, there is a strong tendency for waters, as they exist under natural conditions, to purify themselves. This natural purification is brought about by various physical and chemical actions, which may lead to the partial or complete removal or destruction of the contaminations and pollutions which a water has suffered.

Sedimentation is one of the most active forces at work in the self-purification of water. It affects the suspended matter; and, under favourable conditions, it would, no doubt, in time collect all substances of greater density than water at the bottom of the stream or lake. But we know that the conditions for sedimentation are not always favourable. Large bodies of still water offer great opportunity for sedimentation to occur; yet the force of gravity which induces it is in many instances overcome by currents, which may be caused by the winds, by the effects of heat and cold, or by the tributaries or outlets. In streams, the larger of the suspended matters are often soon deposited on the bottom or on the banks; but many of the finer and lighter particles are sometimes carried for long distances, dependent upon the force and flow and other conditions present in the stream. Oxidation and other chemical changes occur in both the dissolved and suspended matters in water, and are active factors in self-purification; but these changes are greatly influenced by temperature, by light, and by the kinds and the number of bacteria and other living things which are present.

Another means of purification of water is from the death of many of the living things contained in it. The disinfectant action of light, especially of direct sunlight, has been shown to exert a marked influence upon the bacteria; and many of these organisms are killed by extreme cold. Other causes are also actively at work in destroying the bacteria and other forms of life.

Again, in the ground waters a most active purification is effected through filtration. As the water percolates the soil, the grosser of the suspended matters are left upon the surface; and many of the finest ones are removed in different parts of the filtering medium, and remain adherent, through various agencies, to the sand and gravel, while the water passes by. This purification by filtration is by no means purely a mechanical process, in which the bacteria are held back because the pores in the soil are so small as to retain them; for it has been shown that the soil alone will not filter out bacteria. It is not until after a slimy deposit has been formed upon the surface of the sand and gravel that filtration is effected; and it is therefore this layer of slimy substance which effects the purification.

Although these various agencies are often wonderfully effective in purifying water, they do not always render it pure. It is not sufficient for sanitary purposes to know that a water has flowed a given number of miles over the surface, or that it has filtered through so many feet or yards of soil; but we must know either that a water has never been polluted, or, if once polluted, that it has been properly purified, before it can be judged as suitable for drinking. To know that a water has never been polluted, it is necessary to trace it through unpolluted surroundings from the time when it falls as rain until it is received for use. In populous countries, such an unpolluted water is not easy to find; but wherever it may be found, it is a treasure.

In the majority of cases, however, in which the water cannot be followed in its wanderings, or in which it has evidently been subjected to pollution from human, animal, and house waste, there must be positive evidence that it has undergone adequate purification before it should be used for drinking, or even applied to general domestic purposes.

To determine the degree of purification which a water has undergone, it is submitted to certain analyses. These analyses seldom give definite information as to whether or not infectious substances, such as disease-producing bacteria, are contained in the water; but, as has well been said, water analyses are a "series of experiments undertaken with a view to assist our judgment in determining the potability of a supply." They determine certain important facts, which must be considered in connection with all the conditions surrounding the water; and the value of any water analysis "rests upon its interpretation" in the light of this external evidence.

Our knowledge on the subject is sufficiently exact to state that many bacteria of disease are capable of living in water for considerable periods of time, and that water may carry them in suspension for great distances. In the process of purification, some of these bacteria may die, and some may be removed by sedimentation or filtration; but, under ordinary circumstances, we can have no positive assurance that all harmful bacteria have been removed or destroyed by the agencies which effect purification. Dilution of polluted water cannot properly be said to purify it, because it neither removes nor destroys those living things which induce disease. It certainly lessens the chance of infection for every consumer; but chance of infection still remains where none should be.

The analyses on which we rely for information in regard to the pollution that water has suffered, and the degree of purification it has undergone, are the chemical, microscopic, and bacteriologic.

Chemical analysis is used to "determine the amount of mineral and organic matter dissolved or suspended in water, and, so far as it is possible, to determine the character and condition of the organic elements." The presence of inorganic substances is thus disclosed, which may render the water unfit to drink, or unsuited to other domestic or to manufacturing purposes. From this analysis we also learn much concerning the organic matters found in water, which, from their character, abundance, and the degree of their oxidation, often give valuable information concerning the kind, extent, and remoteness of pollution.

Microscopic analysis reveals the nature of much of the suspended matter in water—whether it be living or dead, and whether its source be animal or vegetable. Among the minute vegetable organisms in water which are revealed by the microscope are the bacteria—a group of especial significance, because among them are to be found the germs of certain serious infectious diseases. Special methods are required for the study of these organisms; and they are used in water analysis to determine the number and kinds of bacteria present, to decide upon the efficiency of purification by methods which aim to remove or destroy the bacteria, to discover the bacteria of disease, and also for the study of the vitality of known species of disease-producing bacteria, in waters of different compositions and under varied conditions.

All bacteria found in water, or their progenitors, have been derived from extraneous sources. The great majority of them are not in any way harmful to man; and their presence in water is important to induce and promote the chemical changes which dissolved and suspended matters undergo in the process of purification. Many of the harmless species are known to multiply in potable waters; and some of the disease-producing forms, although they rarely multiply to any great degree, have been found to remain alive in water for varying periods of time—in some instances, for several months—while others are usually rapidly destroyed.

Numerous cases are on record in which bacteria of disease have been found in polluted streams. The difficulties usually met with in the search for these organisms in waters which contain a large number of other bacteria are very great; and the chances of discovering the disease-producing forms are small. Although a number of them may be present, and may infect persons using the water, yet by the time the disease they induce has developed, and suspicion that the water is infected has been aroused, it is quite as likely as not that the disease germs will have disappeared from the supply. The discovery of disease-producing bacteria, however, is not the primary object of bacteriologic water analysis, as we know, without any kind of analysis whatever, that they may be present in polluted waters.

The number of bacteria a water may contain and yet be considered wholesome cannot be stated, as the conditions surrounding the sources of supply are so different. Contamination of water from an uninhabited region is without significance from a sanitary standpoint, while pollution by sewage or excrementitious matter, be it ever so slight, is a menace to health; and yet the number of bacteria found might vary to any degree in favour of either of such waters. Arbitrary standards of purity have been set; but they have little intrinsic value in determining the salubrity of natural water. An enumeration of the bacteria may aid materially in determining the amount of pollution, or the degree of purification of a water; but the number found gives no clue to the sources from which these bacteria are derived.

Nearly all waters contain bacteria in greater or less numbers; and analysis shows that, as a rule, many more bacteria are contained in surface waters than in ground waters, while running waters are found to contain more than lakes and other bodies of still water. In surface streams running through inhabited districts, the number of bacteria received from the washings and pollutions of the banks, and from tributaries, often far outnumber those removed by self-purification; and it will be found that such streams generally contain larger numbers of bacteria at their outlets than at their sources. This is

especially true in rivers where cities and towns, located on the banks, empty their waste and sewage directly or indirectly into the stream. At the points of contamination of the water, the number of bacteria is usually enormously increased; and through the agency of self-purification they often again gradually decrease, although some increase in the total number of bacteria actually found will frequently be maintained.

In unpolluted bodies of still water, it is usual to find fewer bacteria than in running waters, partly for the reason that lakes and ponds are often largely fed from the naturally filtered ground water through springs, and also because they offer better opportunities for self-purification by sedimentation. The number of bacteria in unpolluted ground waters is generally small; great numbers of them being removed by the filtration which the water undergoes in percolating the soil. Water which is grossly polluted, when thrown upon the surface, may become thoroughly purified so far as bacteria are concerned, after filtering through a few feet of the proper kind of soil. The greatest amount of suspended matter is left on the surface; and as the water sinks, it is gradually freed from the smaller particles, until at some point, usually about 6 feet below the surface, under favourable conditions, but few bacteria are found. Much of the ground water, however, does not undergo adequate purification, as the filtration may be incomplete, and water from the surface may pass without any filtration whatever through some fissure or channel directly to the deeper layers of soil.

It is all-important that wells sunk to receive the ground water, or to conduct it to the surface, should be so constructed as to exclude all surface and superficial contaminations. For this purpose, they must be absolutely water-tight down to the point at which they are in communication with the underground sources; and they must be protected by grading and cementing the earth surrounding them in such a manner that the surface water will flow away from them and not into or towards them. Water from shallow wells is derived from percolating water from the immediate vicinity. This superficial ground water is afforded comparatively little chance for purification, and is extremely liable to pollution from the surface and from the adjacent soil. As a rule, properly constructed deep wells provide a much safer supply, as the percolating water which feeds them has been allowed greater opportunity for self-purification; but they are also liable to pollution by sewage and drainage from human habitations situated near the sources from which the water is derived.

When deep ground water is obtained from porous soil, and held under pressure beneath impermeable strata of rock or clay, its source is usually a remote one; and in passing through the porous soil, the best opportunity is afforded for its filtration. The impermeable stratum which prevents it from rising to its proper level also protects it from the contamination which the soil over it has received. Such waters, when tapped by boring, rise directly in the pipes let down to conduct them, and may flow out upon the surface. These are artesian wells; and they usually, though not always, supply a water which is freed from the pollutions of the surface and the soil, through the various agencies which effect purification.

Numerous methods of artificial purification of water have been used; but it is not my purpose to consider them here, except to say that they are modelled upon one or more of the processes which effect natural purification. Some of them are efficient in removing or destroying many bacteria, and in producing oxidation of the organic impurities. But they are necessary only when a polluted water must be drawn upon as a source of supply; and they always require the most intelligent care and management to produce satisfactory and safe results. Many so-called domestic filters are simply strainers; and, in spite of a widespread belief entertained to the contrary, they really do not purify the water.

It would appear then that, in inhabited regions, many of the waters, whether found upon the surface or in the soil, are liable to pollution from the insanitary methods of sewage disposal which so often prevail; and we are therefore forced to rely largely upon the natural agencies which purify water to remove or destroy the impurities and render the water safe to drink. Although natural purification may rid a polluted water of many of its dangers, we cannot always be sure that it has removed them all; and if a supply from unpolluted sources cannot be obtained, we should seek our supply of natural water from such waters as have been most purified. In general, it may be said that surface waters are not usually afforded the same chance of purification as ground waters; and when drawn from populated areas, they are therefore less suitable for domestic supplies. Both the surface and superficial ground waters in inhabited districts are especially liable to repeated sewage pollution; and the opportunities afforded them for natural purification are not so great as those of the deep ground waters. It is from these, therefore, that we have the best chance of securing a supply of wholesome water; and among them the preference must usually be given to those which supply the artesian wells, as the water is obtained from a remote, and perhaps an unpolluted source, and is protected by an impermeable stratum from pollutions of the soil that lies over it.

These conclusions only indicate the sources from which, in inhabited regions, we may hope to find an unpolluted or a purified water. Each supply must be considered on its own merits, and in the light of all the information which can be secured concerning it. We must know not only that opportunity for purification has been afforded, but also that purification has been effected. The difficulties which are met with in finding a supply of wholesome water, and the enormous expense often attendant upon securing it, may ere long render it necessary for the public to decide whether or not their best interests are served by using the streams, lakes, and ground waters in their vicinity for the disposal of sewage, or for drinking water. It has been demonstrated over and over again that the sanitary disposal of sewage is both possible and practicable; and yet the soil is continually fouled with human excrement and waste, and the surface waters are polluted with sewage. On account of this wholesale pollution, it has become necessary for us to find a supply of potable water where we may. It is not easy to discover in the vicinity of so-called civilized communities; and although we seek it with better chances of success in the bowels of the earth, we are not sure to find it even there.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The road-roller question as it affects gas-pipes has been raised in the Fifeshire Sheriff Court, in an action by the Kincardine Gaslight Company against the County Council. The pursuers conclude for interdict of the use of a steam road-roller in the streets of the town, and for £10 16s. 8d. of damages for gas-mains which were broken by the roller in 1892. They state that their pipes were laid in 1846, with the sanction of the then Road Trustees; and they maintain that the use of a roller of such weight as the defenders employ to repair the roads is new and quite unnecessary. In defence, it is not admitted that any sanction was given for the laying of the gas-pipes; and it is maintained that they were placed only a few inches from the surface of the ground, and that they are now old and liable to breakage. Sheriff Gillespie, in a judgment he has given, finds that the pursuers' averments are not sufficient to support the conclusion for interdict, but continues the case on the conclusion for damages. He said that the Gas Company had no statutory powers to lay their pipes under the roads; and that they had only vaguely stated what was the foundation of their alleged right. He did not think it at all likely that the Road Trustees would have given away the rights of the public without a full clause of indemnity for any damage that might happen to the pipes. He points out, too, that it is not averred that the sanction was unconditional; and, further, that the Road Trustees had no power to tie the hands of themselves and their successors indefinitely, by such an obligation as the pursuers' contention requires. Putting their case at the highest, the utmost the Company could claim was that they should get reasonable notice of the termination of the *quasi*-contract, which might let in their claim for damages. Pursuers' Agent stated that the damages were not worth fighting for, if the Road Trustees could give them notice to quit; and that then their best policy would be to make the most advantageous terms they could with the defenders. He also stated that the decision upon the question of interdict would be appealed. It will be satisfactory to have the law of the question decided. If it should go against the Gas Company, it is clearly a case for terms. At the same time, it would not be a handsome thing if the Road Trustees, should they win, were to impose harsh conditions upon the Company.

The County Council of Stirlingshire are going to oppose both the Gas Bills for the burgh of Falkirk in Parliament. In support of this step, a meeting of residents in the Larbert and Stenhousemuir districts was held on Monday night, at which resolutions approving the action of the County Council were adopted. These districts are included in the area scheduled by both Bills; and it is felt that the interests of the residents might be prejudiced by the passing of one or other of them without protective clauses. For instance, the Chairman of the meeting said they might be precluded from erecting gas-works of their own; and they might not be charged the same price for gas as consumers in Falkirk. These reasons are both quite cogent; and the promoters of the Bills will act wisely if they agree to insert protective clauses. If they do not, the opposition of the County Council may have a disturbing effect in the parliamentary proceedings.

There are indications that the proposals of the Dundee Corporation with reference to the Gas Commissioners will be carried through Parliament without opposition. A meeting of the Gas Commission was held on Wednesday, at which a motion was to have been considered, to the effect that they should oppose the Corporation Bill; but the mover, one of the representatives of the Chamber of Commerce, asked that the subject should be delayed till the outside bodies had considered the Bill, as they might then be prepared to adopt it. The delay asked was granted. This is gratifying information, as it would be little short of a scandal if the representatives of the outside bodies were to raise a conflict over their retention in the Commission. What has led to the collapse of the opposition is that the opinion of Counsel has been obtained on the question of who would be liable for the costs of the opposition in Parliament; the opinion being that the parties promoting the opposition would themselves be personally liable. It is one thing to oppose with the funds of a public body, and another to oppose at one's own expense—particularly when the supposed benefit to be obtained is not a personal matter.

At the Commission meeting, the Lord Provost offered a personal explanation regarding a statement he made at a former meeting, as to the indebtedness of the Commission. He then said that it amounted to half a million sterling. Mr. J. Mitchell, in a letter to the newspapers, contradicted the statement, and made out the sum to be only £355,000. The Lord Provost now makes it up to £434,000, by adding the cost of the electric light installation, and other items. One item of £35,699 is an overdraft from the Bank, which is surely too large a sum to pay a high rate of interest upon. The Commissioners might, with advantage, consider whether they could not finance their undertaking without requiring to resort to this method of raising money to carry it on with. It looks strange, too, that there should, after a month's consideration and inquiry, be any question among the members of the Commission as to the amount of their indebtedness.

There seem to be in every Corporation dealing with the subject of electric lighting one or more members who are rabid over the subject. In Aberdeen, that man is Mr. M'Kenzie, who was at one time Convener of the Gas Committee. At Monday's meeting of the Town Council, he moved that, in addition to the ten lamps which had been erected in Union Street, they should put up six arc lamps in Union Terrace; the reason given being that, unless this was done, there would be current running to waste. The proposal was opposed, on the ground that Professor Kennedy had advised them not to go in largely for street lighting, and that it was not advisable to devote one-fourth of the capacity of the station to street lighting until they saw what the demand would be for private purposes. It transpired that the proposal was made on the advice of the Engineer, who wished to equalize the load. I cannot say that I understand his meaning; but I should interpret it to be that the Engineer does not expect much demand for incandescent lighting; and that he wishes to have as large an output as possible for public purposes, in order to conceal the nakedness of the adventure. Mr. M'Kenzie's proposal was defeated.

The Corporation of Stirling have received intimation from the Board of Trade that they have declined to sustain the refusal of the Corporation to consent to the application of the Caledonian Electric Supply Company for a Provisional Order to light the town. The action of the Board of Trade is based on the fact that the Corporation, in their answers to the memorial of the Company, do not themselves undertake forthwith to apply for a Provisional Order, but merely state that they intend to apply. This seems to the Board of Trade to be "hanging up" the subject, which they object to. The refusal of the Board is, however, put on the technical objection that 30 days' notice was not given of the meeting of the Council at which the subject was considered. To remedy that, a special meeting is to be called to again consider what steps they will take. This action of the Board of Trade bears out the remark of Lord Provost Russell, of Edinburgh, at the Glasgow banquet a week or two ago, that the local representatives of the people were apt to be overruled by permanent officials. Stirling is just in the same position as other towns; it is being forced into the taking up of electric lighting, whether the community, as a whole, want it or not. Of course, the blame lies with some of their own number, who have of late kept talking of its introduction. This was done, I believe, with no honest intention to introduce the light, but simply to annoy the Gas Company. In that view, the Town Council deserve the trouble they are being put to. It is instructive to consider, in this connection, that Perth is being left alone by the electricians; there being there no itching by any of the public men after the new-fangled light, and consequently no prospective demand for it.

Professor Kennedy seems to have given up cast-iron culverts, and to a large extent bare copper strip, for the carrying of electricity. It is announced to-day that he has advised the Corporation of Edinburgh to lay their electric light mains in culverts of some other material—preferably of clay—and to use insulated cables for all the distributing mains. Most probably the explosions in Glasgow have had something to do with this change of opinion. The Lord Provost's Committee of the Town Council this week let contracts for the supply of plant for the central electric lighting station to the amount of £24,300. The power is to be derived from Willans and Robinson engines of 1500-horse power, which is one-fourth of the ultimate capacity of the station. The dynamos are to be supplied by Siemens Bros., and are to be coupled direct to the engines. Messrs. Crompton, Howell, and Co., have secured the contract for the storeage batteries.

The Edinburgh and District Water Trust have practically thrown over the St. Mary's Loch scheme for the augmentation of the water supply; and the same may almost be said of the Manor scheme, which was, till recently, the favourite with the Trustees. In both cases it is the great depth to which the trench for the foundation of the embankment would require to be dug which has led to their decision. The Manor scheme was reported on some time ago; and it was stated that a solid foundation was not reached till depths of from 62 to 150 feet were reached. The results of borings at St. Mary's Loch were reported to the Trust this week. One bore went down 84 feet; and the Engineers reported to the Works Committee that they had then found a solid bottom. This was printed in the minutes of the Committee, and laid before the Trust. At the meeting, however, a letter from the Engineers was read, in which it was stated that the solid bottom had turned out to be a boulder, and that the bore had, since they reported, gone down to 100 feet without a bottom being found. The subsoil, too, was of loose gravel, and was saturated with water. The bores were put down on the line of the proposed embankment, about 400 yards down the valley from the loch; and it is known that the whole of the intervening subsoil is gravel. The consequence is that any attempt to dig a trench would lead to the water filtering in; and, practically, the loch would require to be drained dry before a foundation could be got, which is next to impossible. A curious illustration of the persistency of ideas is furnished by the fact that the loch scheme, even after these results are published, is still supported by the teetotal section of the community. This is due to the circumstance that, in the controversies of 1871, which resulted in the Moorfoot scheme being adopted, the St. Mary's Loch scheme was stoutly advocated by a prominent teetotaller, who has never forgiven his defeat on that occasion. It is, of course, a silly way to look at a public question of such importance; but it is being so looked at, and before the loch scheme is finally given up there will most probably be a struggle by the teetotal section to try to force it upon the community. It seems that in 1871 the estimate was that the loch would furnish 120 days' supply, without engineering operations. This is now considered to be insufficient; the Engineers thinking that a supply for 180 days is necessary. They therefore propose that, if it be adopted, the level of the loch should be raised 14 feet. The popular notion, and the one which led to many favouring the loch scheme, was that it could be used as a natural reservoir, and cost would therefore be saved; but this being now out of the question, many followers will fall away from it. The only proposal before the Trust is that of the Talla and Fruid, both of which are head waters of the Tweed. There a solid foundation has been got at 40 feet in the valley of the Talla, and at 28 feet in that of the Fruid. A new line of borings farther down the Talla Valley, where rock is expected to be got at a less depth, is being made. If this expectation should be realized, there is little doubt that the Talla scheme will be greatly strengthened. It is still further supported by the reports as to the samples of water which have been taken from both the Talla and the Fruid. These show the water to be, even in flood, remarkably free from peaty stain; and both streams rapidly recover their clearness after flood. The Trust are going into the subject exhaustively, having so far expended £820 upon boring and other operations, to enable them to make up their minds as to the best source of supply.

Mr. John Mullins, the "diviner," has this week been employed by the Earl of Camperdown to prospect for water supplies on a number of his Lordship's farms which last summer suffered from want of water. He was very successful in the working of the divining-rod, but, of course, his discoveries have yet to be tested, which there is little doubt they will be. Mr. Mullins not only pointed to where water would be found, but mentioned the depth at which it was, and the quantity. He even went so far as to state, in one instance, that, if water were not found where he said it would be, he would pay the cost of digging the well. A circumstance occurred on one farm which should go far to make many converts to a belief in the efficacy of the divining-rod. The company were walking on a grassy slope when Mr. Mullins exclaimed that he had discovered a fine stream flowing not far from the surface. The tenant of the farm explained that the water-main which supplies the town passed underneath. There was no visible indication of any trench having been dug there; and Mr. Mullins was unaware of the existence of a main in the locality.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Feb.* 10.

Sulphate of Ammonia.—The market has been very dull—a circumstance due to the abstinence of consumers, in consequence of reports published by the dealers relating to the existence of large stocks in first and second hands. A contradiction seems unnecessary, as the shipments speak for themselves; and the bright and mild weather has certainly not been conducive to an increased production. Quotations at the ports are meanwhile down to £13 15s. Exactly the same state of things existed last year; but there was a great change during the second half of the month.

LONDON, *Feb.* 10.

Tar Products.—The week has been marked by a decidedly improved demand for carbolic acid. Should this continue, prices will be better both for crude and crystals. Benzols are still very flat; and Toluol, which has been in considerable request, is now participating in the fall which has come upon benzols. Crude 30 per cent., naphtha is now obtainable at a lower price than it has touched for several years. Pitch keeps moderately firm, but is certain to see lower prices if coal continues to go down as it is doing. Tar oils are not so firm; and makers are more anxious to sell. Very little new business is reported; but the following prices have obtained during the week: Tar, 15s. to 17s. Pitch, 28s. Benzols, 50's, 1s. 4½d.; 90's, 1s. 3d. Creosote, 1½d. Creosote salts, 25s. Solvent naphtha, 1s. 2½d. Toluol, 1s. 8d. Crude benzol naphtha, 30 per cent., 7½d. Carbolic acid, 60's, 1s. 9d. Cresol, 1s. 2d. Anthracene, 30 per cent., "A," 1s. 1d.; "B," 10d.

Sulphate of Ammonia was dull during the early part of the week; and price receded to £13 10s. country ports. It is now firmer, and £13 15s., less 3½ per cent., is readily obtainable; while gas liquor is quoted 8s. 6d. to 9s. 6d. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—There is no very material change to report in the position generally throughout the coal trade of this district; the tendency being still in the direction of a lessening demand for the better qualities of round coal, with an easing off in prices, although there is no actually quoted reduction upon list rates. At most of the collieries stocks are accumulating in increasing quantities, and the competition from outside districts with coal at lower prices is also becoming more keen; but the leading Manchester colliery concerns are remaining very firm at their full list rates. In West Lancashire districts, however, there is a little weakening from the recent maximum prices. It is only in very exceptional cases that best Wigan Arley is now fetching 15s.—14s. to 14s. 6d. being more the average—with Pemberton four-feet and seconds Arley obtainable at 12s. 6d. to 13s.; and common coals, suitable for house-fire purposes, at 11s. to 11s. 6d. The lower descriptions of round coal still move off fairly well; and prices for inland sales are steady at about 10s. to 10s. 6d. per ton at the pit mouth. In the shipping trade, there are, however, lower prices ruling; and Lancashire steam coal, delivered at the ports on the Mersey, is only in special cases fetching more than 11s. 6d. per ton, with sales reported at under this figure. The better sorts of engine fuel, owing to the lessened activity in round coals, are not so plentiful in the market. Prices are well maintained at about 8s. to 8s. 6d. for burgy; 6s. 3d. to 6s. 9d. for the best qualities of slack; and common sorts ranging from 4s. 9d. up to 5s. 6d. per ton at the pit mouth.

Northern Coal Trade.—In the coal trade of the North there is increased ease; and prices of steam and bunker coals are lower, though any reduced output is mainly from the steamers being unable to reach the coal spouts as readily as they should. Best Northumbrian steam coals are quiet at 10s. 9d. to 11s. per ton f.o.b.; and small steam coals are also lower—3s. 6d. to 3s. 9d. per ton being the general quotation. In gas coals, the efforts of some of the coalowners to form an association to keep up the prices to from 7s. 6d. to 8s., according to quality, seem likely for the present to have some success. But the fact that the Newcastle Gas Company, who have had to pay increased rates this year, are going to raise the price of gas, is likely to lead to the public more readily appreciating the matter. Gas coals, for odd cargoes, are quoted at from 7s. 6d. to 9s. per ton f.o.b.; the higher price being for coals of approved quality that at all times are in demand. It is believed that the association will be formed by from ten to fourteen firms; but the leading members and the officials refuse all information, except that some "progress is being made." Coke is rather lower—at from 14s. 6d. to 15s. per ton f.o.b. Gas coke is unaltered in price.

Scotch Coal Trade.—The week has been a dull one in the coal trade. There has been a continuance of very stormy weather, which is retarding shipping, with the result that coal-waggons are being left standing loaded, and are consequently scarce. This has led to some pits being put upon half time. There has also been a scarcity of new orders; and it is supposed that Continental buyers are holding back, in the expectation of easier terms. Only a very few manufacturers are laying in stocks, as there is a general belief that no further trouble will be experienced with the miners. The masters refuse to meet the representatives of the men on the subject of a Conciliation Board, unless the preliminary demand for an advance of 6d. per day is withdrawn. This is a clear indication of how strong the masters consider their position to be. Prices have again tended downwards

They are given at: Main, 8s. 6d.; ell, 9s. 3d. to 9s. 6d.; splint, 9s. 3d.; and steam, 9s. 9d. to 10s. f.o.b. Glasgow. Shipments were low, amounting for the week to 123,033 tons—a decrease of 16,775 tons upon the preceding six days, but an increase of 21,004 tons upon the corresponding week of last year. For the year to date, the total shipments have been 644,102 tons—an increase over the same period of last year of 178,195 tons.

The Bodmin Water Company have accepted contracts for laying an 8-inch main from Hamatethy to Bodmin—a distance of 7¼ miles. The estimated cost of the completed work is £7000.

Gas-Works Extensions at Burnley.—The Burnley Corporation Gas Committee have decided to purchase 2500 yards of land for the extension of the gas-works. It is on the northern side of the present works, and adjoins the River Calder. It has also been decided to proceed with the enlargement of the gasholder No. 1 at Stoneyholme, at an estimated cost of £5000. The Corporation have received sanction from the Local Government Board for the borrowing of £9100 for a new holder, new offices, sulphate works, and laboratory, and £5500 for additional purifiers.

The New Machinery at the Manchester Gas-Works.—In the minutes presented by the Gas Committee to the Manchester City Council last Wednesday, there was a report on the visit paid by the Committee to the Bradford Road station, to witness the inauguration of the new charging and drawing machinery recently described in the JOURNAL (*ante*, p. 113). The Committee stated that they were much pleased with the work completed and the work in hand, and expressed themselves well satisfied with the management of this important station. They were glad to learn that the men engaged on the drawing and charging machinery worked willingly, and quickly became acquainted with their duties.

The Leicester Corporation Electric Lighting Scheme.—An exhaustive report (prepared by the Gas Engineer, Mr. A. Colson) with regard to the tenders for the supply of four horizontal compound condensing engines for the central electric-lighting station at the Aylestone Road Gas-Works was under consideration at a special meeting of the Leicester Town Council yesterday week. The report recommended the acceptance of a tender by Messrs. Hick, Hargreaves, and Co., of Bolton, for engines equal to 1185 indicated horse power, at the sum of £4695. An amendment was proposed in favour of Messrs. Jessop and Son a local firm; but this was negatived, and the Committee's recommendation was passed.

Sales of Shares.—Messrs. Renny and Clark, of Southsea, at a recent sale, obtained the following prices for shares in the *Portsmouth Water-Works Company:* £14 apiece for 1861 £5 shares; £9 10s. for 1879 £5 shares; and £8 10s. for £5 shares of which £4 had been paid. ——At the Saddle Hotel, Bolton, Messrs. Hayhurst and Taylor offered for sale last week nine perpetual gas annuities of £1 13s. each guaranteed by the *Bolton Corporation;* and they realized £457 4s., or £50 16s. each. At the same time £105 of "B" consolidated stock of the *Farnworth and Kearsley Gas Company* sold for £167 10s.——Messrs. Lyon and Carter, of Chester, have recently sold by auction £750 of consolidated stock in the *Chester Water-Works Company* for £1245.

Exhibition of Gas Appliances at Norwich.—The attention which is being given in Norwich to improved cookery, by the institution of a School of Cookery and the establishment of cookery classes, has prompted the British Gaslight Company to hold another exhibition of gas appliances in the city; and the Assembly Room at the Agricultural Hall was secured for the purpose. A good collection of stoves was brought together; and the exhibition was opened on Monday last week, when Mrs. Wilkinson gave a cookery lecture, with demonstrations, to a large audience. These were continued twice daily during the week. The Hall was brilliantly lighted; some of the newest types of high power and other burners being on view. The exhibition was under the direction of Mr. F. E. Linging, Assoc.M. Inst.C.E., the Company's Engineer and Secretary.

Sittingbourne Water Supply.—At a meeting of the Sittingbourne Local Board recently, it was decided to apply to the Local Government Board for power to borrow £5000, to be expended upon the enlargement and improvement of the water-works. At present there is a dearth of water at Sittingbourne. The water-works, which belong to the town, are situated about two miles away, where pure water is obtained; but, owing to the increasing demand throughout the district, the Board are unable to keep up a continuous supply. The reservoir contains only sufficient water for twelve hours' consumption; and during the late frost it was emptied in a single night, and some parts of the district were without water for many hours. Seeing that it was impossible to continue this hand-to-mouth policy with any degree of public safety, the services of Mr. E. Easton, M.Inst.C.E., were obtained; and upon his report it has been decided to enlarge the supply, and to put down modern plant.

The Accident through an Electric Current at Bournemouth.—The Board of Trade have issued Major Cardew's report on the electric accident at Bournemouth last month, by which a horse was killed. He says the death of the horse was extraordinary, considering that the electric current reached the animal though several inches of roadway. The death was primarily due to electric shock; but it was accelerated by enlargement of the heart. Major Cardew does not consider there is any appreciable danger to human life; but the occurrence was sufficiently serious to call for the application of a remedy. He adds: "In order to prevent any recurrence of similar accidents, the Company should, in my opinion, take the following steps: (1) Immediately replace all cables used for high pressure, similar to that which caused the accident, by larger cables, having a thickness of insulation of not less than 0·1 inch of best quality india-rubber, or some equally efficient material; (2) connect together all the pipes in which high-pressure cables are contained, and wrap the cables, where they pass through street boxes, with a sufficient covering of sheet lead, or encase them in iron cases also connected with the pipes, so that the cables should be enclosed throughout in metal casing in connection with earth over the full extent of thesystem."

Bolton Water-Works Extensions.—At the monthly meeting of the Bolton Town Council last Wednesday, it was stated that the Corporation were applying for powers to borrow £20,000 for the extension of the water-works.

The City and Guilds of London Institute.—The Executive Committee of this Institute have changed the name of the Guilds Central Institution, in Exhibition Road, South Kensington, to the Guilds Central Technical College.

Encouraging the Use of Gas at Bury.—The Bury Town Council approved last Thursday of a resolution passed by the Gas Committee authorizing the Manager to provide consumers with burners for boiling water, &c., free of charge, and to let out grillers at a rental of 2d. per quarter. In each case the hirer is to sign an undertaking for the safe custody of the article, and its re-delivery to the Corporation.

Gas Companies and Electric Lighting in France.—A few years ago, the municipal authorities of St. Etienne and Montluçon were ordered by the Council of State to compensate the Gas Companies for giving permission for the introduction of the electric light. According to the Paris Correspondent of *The Times*, the same tribunal has lately given judgment in favour of a claim for the assessment of damages by the Gas Company of Argentan against the Municipality of that town. The latter had not only allowed an electric light company to lay down wires, but had granted it the use of a site for works. The judgment contains a recital that, whenever a gas company has been accorded a monopoly for any fixed period, compensating advantages have always been guaranteed to the local authorities in the shape of cheap rates or participation in profits.

Proposed Extension of the Wigan Water-Works.—An inquiry was held at Wigan last Wednesday, by Colonel J. Ord Hasted, of the Local Government Board, respecting an application by the Corporation for power to borrow £12,000 for the purpose of extending the water-works. From the Town Clerk's statement, it appeared that up to 1886 the Corporation had borrowed £163,558 for the purpose of the undertaking. In 1892 they received further borrowing powers to the amount of £12,000, of which they had expended £9964, and the balance of which is required for the immediate duplication of a main from one of the reservoirs. Of the £12,000 for which powers are now sought, £6345 is to be expended on mains for new streets, &c., and the Corporation asked that while the Provisional Order should give general powers in regard to the £12,000, the Local Government Board should sanction the immediate borrowing of £7000 of it. No opposition was offered to the loan.

The Late Water Engineer of Nottingham.—Last Wednesday evening, a public meeting was held at Nottingham to hear an address by the late Borough Water Engineer (Mr. Godfrey T. Evans) on matters relating to his recent resignation. A local contemporary describes the statement as "unreportable;" but mentions that, in his introductory remarks, Mr. Evans said his object in calling the meeting was to lay his case before the ratepayers with a view to having it re-opened before a Government inquiry. It was rather late in the day to appear before the public; but this step was entirely owing to reports of the most damaging character which had been circulated respecting him. He then dealt at great length with all the charges which were the subject of investigation by the Committee appointed to consider them. Several motions were afterwards submitted to the meeting; the one which received the largest amount of support being—"That this meeting having patiently heard Mr. Evans's statement, is of opinion that the demand of the Town Council that he should resign was unjust."

The Electric Lighting Question at Harrogate.—At the request of a number of influential ratepayers of Harrogate, a meeting was convened for last Thursday by the Mayor (Mr. C. Fortune, J.P.), for the purpose of considering the electric lighting question, and determining as to the expediency of the Corporation undertaking the installation and supply of the electric light "now that the public burdens are likely to be much increased." Among those who signed the requisition to the Mayor was Mr. Samson Fox; and, at the close of a long speech, he proposed a motion disagreeing with the Corporation entering into any scheme of electric lighting at the town's expense, and asking that the question should be reconsidered, with the view of the Corporation transferring their rights to an independent and private company. To this an amendment was submitted, supporting the Corporation in the action they had taken, and expressing the opinion that the progress made in electric lighting in England and abroad justified them therein. On being put, the amendment was lost; and the motion was then declared carried by two to one. The subject was debated in a meeting which lasted three hours. It now remains to be seen what the Council will do in the matter.

The Bridgnorth Town Council and the Divining-Rod.—For some time the Bridgnorth Corporation have been endeavouring to find a spring of water at a sufficiently high level to supply residents in a certain district by gravitation. At the Council meeting last Tuesday, the General Purposes Committee reported that they had obtained the assistance and advice of an expert, who assured them that a strong spring of water could be found at a moderate depth from the surface of a field in Conduit Lane. According to the discussion which followed, the "expert" appears to be a Mr. Mullins, who works with a divining-rod, and whom the Committee engaged for £7. Complete unanimity of opinion does not reign in the Council on the subject of the wisdom and propriety of this step. On the contrary, one member (Mr. Beech) bluntly observed that "no greater piece of humbug could be imagined." Nevertheless he declared that he was willing to be converted. "We can soon convert you" was the reply of the Mayor (Alderman Burton), who subsequently added that he could convince Mr. Beech that the hazel rod had the power of finding water. "When I had hold of it," he continued, "the rod worked my muscles; and it would tell which way the water ran." More than this, where Mr. Mullins had said there was a spring at 30 feet deep, they had actually found one at 25 feet. Still Mr. Beech was unconvinced; nor did the Mayor's explanation that the rod's action is "a combination of electricity and magnetism" prevent his indulging in ironical observations. The report was adopted.

The Bexhill Local Board and the Gas and Water Works.—On the motion of Dr. Wills, the Bexhill Local Board recently resolved to take into consideration the question of acquiring the property of the Gas and Water Company; and the Clerk was requested to report as to the powers they possessed in regard to the matter at the next meeting of the General Purposes Committee.

The South Metropolitan Gas Company and the Proposed Reduction of Illuminating Power.—At a Vestry meeting of the parish of St. Paul, Deptford, last Thursday (Mr. Pitt presiding), Mr. Wheatley moved, pursuant to notice: "That a letter be sent to the Board of Trade, protesting against any reduction of the standard of illumination of gas." He said the South Metropolitan Gas Company were at present bound to supply 16-candle gas; and it appeared that, by reducing the standard to 14 candles, they could make gas 2d. per 1000 cubic feet cheaper. Of this sum, 1d. was to go to the ratepayers, or rather the consumers of gas, and the other 1d. to shareholders. (A Voice: That is fair enough.) He thought the standard in London was very low compared with that existing in several provincial towns. In Manchester it was 19·1 candles; in Nottingham, 19 candles; in Liverpool, 20 candles (though it was generally supplied at 21·6 candles); in Glasgow, 21 candles; in Bradford, 18½ candles; and in Huddersfield, 19½ candles. Several members asked what price was charged for gas of the quality stated. Mr. Wheatley said he was not able to answer the question. As a Vestry, they ought to protest against any reduction in the standard. Mr. Knight seconded the motion, being convinced that the public would not be benefited by the proposed reduction. Mr. Stagg supported the motion, and complained of the bad quality of the gas at present supplied. If any alteration were allowed, the number of street-lamps would, he said, have to be increased. Mr. Soper pointed out that, by using improved burners, the light would be considerably improved. Mr. Doust strongly objected to the suggested alteration; believing that, if the Board of Trade sanctioned the proposal, the price might be raised to the old figure if the Company so chose. Other speakers having addressed the meeting, the motion was carried.

Chesterfield Water and Gas Bill.—A town's meeting was held at Chesterfield last Thursday evening, to consider a resolution consenting to the opposition of the Town Council to the Water and Gas Company's Bill. The Deputy-Mayor (Mr. J. M. Clayton), who presided, assured the ratepayers that the Council were sorry to have to oppose any measure which was intended to increase the water supply; and had the Bill been of a nature at all acceptable to the inhabitants, they would have gladly welcomed it. It was, however, a Bill the Council could not possibly accept, and at the same time do their duty. There were several reasons why this was so. One was the excessive charges which would result; and another was that it was proposed to provide a reservoir by impounding the water of the River Hipper, and they were of opinion that the water compensation the Company proposed to give was not sufficient, and that the river would simply become a mud stream. As to the proposed rates, they were very excessive; and, as a public body, they could but oppose such a state of things. He then moved the resolution sanctioning the opposition of the Council. In seconding the motion, Mr. Locke, a member of the Council, also referred to the question of the rates, and said one-third of the increased charges would fall upon the higher classes, while the artizan classes would have to bear the burden of the other two-thirds—in fact, Chesterfield would have to pay £10,000 a year in extra rates at least, while the outlying districts would have to pay another £5000. This, extended over seven years, meant an extra income of £105,000 to the Company, besides which, if the Bill were passed, they would get another £100,000 capital. On the other hand, the town had hoped to buy up the concern; but if the Bill passed, it would practically put it out of the power of the ratepayers for the next 50 years to deal with the monopoly. The motion was unanimously carried.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 277.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Oct.	10½	Alliance & Dublin 10 p. c.	10	17½—18½	..	5 13 6
100,000	10	„	7½	Do. 7 p. c.	10	12—13	..	5 15 5
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 4
100,000	20	14 Dec.	8	Bahia, Limited	20	10½—11½	..	13 18 3
200,000	5	15 Nov.	6½	Bombay, Limited	5	4½—5	..	6 10 0
40,000	5	„	6½	Do. New	4	3½—4	..	6 10 0
380,000	Stck.	16 Aug.	11½	Brentford Consolidated	100	220—225	..	5 2 2
180,000	„	„	8½	Do. New	100	163—168	..	5 1 2
220,000	20	15 Sept	11½	Brighton & Hove Original	20	41—43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	102—105	..	4 15 3
320,000	20	29 Sept.	11½	British	20	44—46	+1	4 17 10
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	20—22	..	5 4 7
51,510	10	„	8½	Do. 7 p. c.	10	15—16	..	5 6 3
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	5½—6½	..	3 1 6
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	98—101	..	5 18 10
150,000	20	13 July	8	Cagliari, Limited	20	27—28	..	5 14 3
550,000	Stck.	13 Oct.	12½	Commercial, Old Stock	100	250—255	+5	4 18 0
165,000	„	„	9½	Do. New do.	100	190—195	+2	4 17 5
160,762	„	14 Dec.	4½	Do. 4½ p. c. Deb. do.	100	125—130	..	3 9 3
800,000	Stck.	14 Dec.	13	Continental Union, Limited	100	230—235	..	5 10 7
200,000	„	„	10	Do. 7 p. c. Pref	100	203—207	+2½	3 16 7
535,000	Stck.	15 Sept.	5	Crystal Palace Ord. 5 p.c. Stk	100	100—105	..	4 15 3
486,090	10	31 Jan.	10	European, Limited	10	22—23*	+½	4 6 11
354,060	10	„	10	Do. Partly paid	7½	15½—16½*	+½	4 10 11
5,646,590	Stck.	16 Aug.	12	Gaslight & Coke, A, Ordinary	100	235—240	..	5 0 0
100,000	„	„	4	Do. B, 4 p. c. max.	100	97—102	..	3 18 5
665,000	„	„	10	Do. C, D, & E, 10 p.c. Pf.	100	275—280	..	3 11 5
30,000	„	„	5	Do. F, 5 p. c. Prf.	100	125—135	..	3 14 1
60,000	„	„	7½	Do. G, 7½ p. c. do.	100	190—195	..	3 16 11
1,300,000	„	„	7	Do. H, 7 p. c. max	100	174—179	..	3 18 2
463,000	„	„	10	Do. J, 10 p. c. Prf.	100	270—275	..	3 12 9
476,000	„	„	6	Do. K, 6 p. c. Prf.	100	165—170	..	3 10 7
1,061,150	„	14 Dec.	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
294,850	„	„	4½	Do. 4½ p. c. do.	100	130—135	..	3 6 8
908,000	„	„	6	Do. 6 p. c. do	100	175—180	..	3 6 8
3,800,000	Stck.	15 Nov.	12	Imperial Continental	100	206—210	+3	5 14 3
75,000	5	14 Dec.	6	Malta & Mediterranean, Ltd.	5	4½—5	..	6 0 0
560,000	100	2 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	107—109	..	4 11 9
541,920	20	15 Nov.	5	Monte Video, Limited	20	12¼—13½	..	7 8 2
150,000	5	30 Nov.	8	Oriental, Limited	5	6—6½	–¼	6 3 1
60,000	5	29 Sept.	7	Ottoman, Limited	5	4—4½	..	7 15 6
166,870	10	31 Jan.	2	Pará Limited	10	1⅞—2⅛*	..	8 17 9
420,000	100	2 Nov.	6	People's Gas of Chicago— 1st Mtg. Bds.	100	98—102	..	5 17 8
500,000	100	1 Dec.	6	and Do.	100	96—100	..	6 0 0
150,000	10	13 Oct.	5	San Paulo, Limited	10	8½—9½	..	5 5 3
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	313—318	+3	4 17 6
1,350,000	„	„	12	Do. B do.	100	255—260	+7	4 12 4
260,000	„	„	13	Do. C do.	100	262—267	+5	4 17 4
750,000	„	17 Jan.	5	Do. 5 p. c. Deb. Stk.	100	150—153	..	3 5 4
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 0
				WATER COMPANIES.				
745,967	Stck.	29 Dec.	10	Chelsea, Ordinary	100	271—276	..	3 12 6
1,720,252	Stck.	13 Oct.	8	East London, Ordinary	100	218—223	..	3 11 9
544,440	„	29 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	147—150	+3	3 0 0
700,000	50	14 Dec.	8½	Grand Junction	50	116—120	..	3 10 10
708,000	Stck.	16 Aug.	11½†	Kent	100	290—295	..	3 17 11
1,043,800	100	29 Dec.	9½	Lambeth, 10 p. c. max.	100	250—255	..	3 14 6
406,200	100	„	7½	Do. 7½ p. c. max.	100	200—205	+1	3 13 2
310,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	128—131	..	3 1 0
500,000	100	16 Aug.	12½	New River, New Shares	100	374—379	..	3 4 0
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk	100	132—133*	..	2 19 3
902,300	Stck.	14 Dec.	6	S'thwk & V'xhall, 10 p. c. max.	100	157—162	..	3 14 1
126,500	100	„	6	Do. D 7½ p. c. do.	100	145—150	..	4 0 0
1,755,066	Stck.	14 Dec.	10	West Middlesex	100	268—273	..	3 13 3

*Ex div.

† Next dividend will be at this rate.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON."

GWYNNE & CO.,

TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

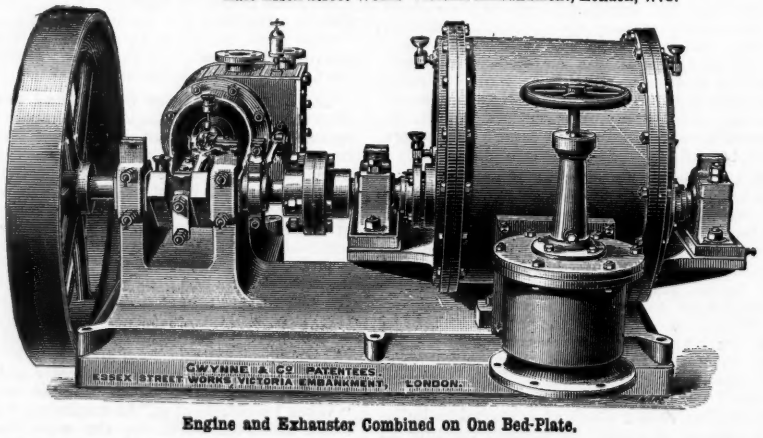
Late Essex Street Works Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent. All communications *re* OXIDE to be addressed to PALMERSTON BUILDINGS, E.C.

BRIN'S Oxygen Company, Limited, Westminster. ANDREW STEPHENSON, Agent.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 200 British Gas-Works. [See also Advt., p. 263.]
ANDREW STEPHENSON, No. 182, Gresham House, Old Broad Street, LONDON, E.C.

LIQUOR, Tar, and Spent Oxide wanted. BROTHERTON AND CO., Ammonia and Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

GOLD MEDAL, 1892.

TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

CHARTERING, FORWARDING, AND INSURANCE

ROBERT BRUCE FITZMAURICE, 29, Great St. Helens, London, Shipping Agent to several Gas Companies and Plant Manufacturers, would be glad to UNDERTAKE LARGE or SMALL SHIPMENTS to any Port.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See last week, p. 225).
Telegrams: "HUTCHINSON BROS., BARNSLEY."

WANTED, by a young Man, total abstainer (age 29), a Situation as MANAGER of small Gas-Works. Moderate Wages. Good references.
Address No. 2332, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Working GAS MANAGER or FOREMAN. Thoroughly conversant with the whole routine of Gas Manufacture and Distribution. Ten years in present Situation.
Address No. 2343, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Gas-FITTER, MAIN and SERVICE LAYER, &c. Well up in Iron and Compo. Pipe, and Stove and Meter Fixing. Good references.
Address WILLIAM BROWN, 92, West Street, Sleaford, LINCS.

EXPERIENCED Engineer will shortly be disengaged. Would undertake Design, Construction, or Management of Gas-Works, or prepare Drawings, Quantities, and Estimates.
References on application to F. G. COCKEY, Gas-Works, WORCESTER.

CLERK (Nine years' experience with Gas Engineering Firm) seeks RE-ENGAGEMENT. Gas Office preferred. Good references. Shorthand. Used to Gas Accounts, and able to read Meters.
Address No. 2337, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Gas Manager. Thorough knowledge of the Manufacture and Distribution of Gas from Retort to Burner, also the Manufacture of Sulphate of Ammonia. At present in a Works making over 21 millions. Has been in present employ thirteen years. Married. Good reasons for leaving. Also good Testimonials. Disengaged March 9.
Address No. 2342, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ROUND Station Meter for Sale. Three inch Inlet and Connections. Very cheap.
Apply to S. E. BARK, jun., Manager, Tenterden, KENT.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield; AND 80, CANNON STREET, LONDON, Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. III., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

TO INVENTORS AND OTHERS.

PATENTS for Inventions Secured and TRADE MARKS REGISTERED throughout the World. Advice on all matters connected with the above. Handbook gratis on application.
J. C. CHAPMAN, C.E., Chartered Patent Agent, 70, Chancery Lane, LONDON.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS, MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.
GAS PLANT CEMENT
FOR ALL LEAKAGES.

A TAR Distiller, having the offer of an important Corporation Contract, out of which large Profits can be realized, desires to meet with a SUBSTANTIAL GUARANTOR, with whom liberal terms would be arranged.
Address No. 2341, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Directors of a small Gas Company (make 8 millions) wish to RECOMMEND a Manager for the post of FOREMAN in a larger Gas-Works. He has a thorough knowledge of Gas Manufacture, and the use of Regenerative Settings.
Apply, by letter, to No. 2339, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ADVERTISER (Aged 43) requires a Situation as an Indoor or Outdoor INSPECTOR, or SUPERINTENDENT on Gas or Water Works. Twenty years' experience as practical Master Fitter in connection with Gas and Water. Total Abstainer. Good references.
Address No. 2336, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Gas-Works Manager. Make about 20 millions. Must be a thoroughly practical Man, with a knowledge of Sulphate Plant. Good references required.
Applications, on or before the 28th inst., to be addressed to the CHAIRMAN, Gas Company, BROMSGROVE.

ENGINEER AND MANAGER.

WANTED, for the Gas-Works of an important City abroad, an ENGINEER and MANAGER. Salary to commence £1000 per annum, with House and Gas.
Applications to be sent (in confidence) to WALTER KING, Esq., "JOURNAL OF GAS LIGHTING," 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Working Manager who thoroughly understands his duties, for Gas-Works, within 30 miles of London, making 10 millions per annum. Must be a good Carbonizer, used to Engine and Exhauster, and able to lay Services and take Indices of Meters. House, Gas, and Coal free. Wages 30s. per week.
Apply, in own handwriting, stating age (if married, number in family), and how soon disengaged, with not more than three copies of recent testimonials, to No. 2340, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, to Hire or Lease, a Small GAS-WORKS. Make of Gas from 700,000 to about 1,000,000 cubic feet.
Apply, by letter, stating particulars, to THOS. POOLE, Gas-Works Lessee, Burgh-le-Marsh, LINCS.

PURIFIERS.

FOR SALE—Four 5 feet Square PURIFIERS, in good condition, lying at Filey.
Apply to HENRY TOBEY, Gas-Works, MALTON.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

DRAWINGS, Tracings, Specifications, Quantities, Strains, &c., prepared by an experienced Gas-Engineering Draughtsman. Plans of Works made, copied, or enlarged. Illuminated Addresses in first-class style. Writings of all kinds, Engrossments, &c.
Address J. H. OPPENHEIM, 27, FORE STREET, E.C.

FOR SALE—Station Meter, with Bye Pass Complete, to pass 9000 cubic feet per hour
Apply to G. E. SAVILLE, Gas-Works, TODMORDEN.

COMPLETE Gas Plant for Sale, comprising three Iron Retorts (6 feet long), Condenser, Scrubbers, Purifier, and Gasholder, together with all necessary Connections and Valves. Suitable for Experimental Works.
For further particulars, apply to W. W. HULSE, Gas-Works, Longton, STAFFS.

TWO Single-Lift Gasholders, about 100 feet diameter by 24 feet deep, one having Wrought-Iron Tank, FOR SALE. In good condition; the only reason for removing them being the enlargement of the Works and Plant generally.
Apply, by letter, to No. 2338, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—The following second-hand GAS PLANT:—
Round STATION METER (6-inch Connections).
9-inch STATION GOVERNOR.
KORTING STEAM-JET EXHAUSTER. Capacity 5000 cubic feet per hour.
One 6-inch FOUR-WAY VALVE.
Two 6-inch RACK-VALVES.
One 8-inch RACK-VALVE.
LIFTING GEAR for Purifier Covers.
Apply to W. MURRAY, Manager, Gas-Works, Limited, UTTOXETER.

THATCHAM GAS-WORKS, BERKS.

TO BE SOLD OR LET.

Fo Removal or Occupation, including the Mains as laid, and the Yard suitable for Coal Trade, situated in the Station Road.

THE Works may be viewed on application, by letter, to the Manager (Mr. G. J. Fyfield); and, if satisfactory arrangements are effected, possession may be had on March 25, 1894.
Offers to be addressed to the Directors of the Company at Thatcham; but they will not bind themselves to accept the highest or any offer.
Dated Feb. 7, 1894.

TENDERS FOR TAR.

THE Directors of the Exeter Gaslight and Coke Company invite TENDERS for their surplus TAR for One Year from Lady-day next.
Delivery on Company's Works filled into Purchasers' Tanks.
Sealed tenders, endorsed "Tender for Tar," will be received by the undersigned on or before Tuesday, the 13th of March next; but the Directors do not bind themselves to accept the highest or any tender.
By order,
W. A. PADFIELD,
Secretary and Manager,
Gas Offices: 248, High Street, Exeter,
Feb. 9, 1894.

TO GAS AND WATER COMPANIES AND MANAGERS.

AN ASSOC.M.INST.C.E. having an extensive experience in GAS and WATER WORKS' DESIGN and ERECTION, now Chief Assistant in a large Gas-Works and Engineer to several small ones, having designed and erected a THREE HUNDRED and a ONE HUNDRED MILLION GAS-WORKS complete, besides several small ones, also ENLARGED many other Works, including NEW LIFTS to EXISTING GASHOLDERS, REGENERATIVE SETTINGS, &c., would be pleased to VISIT WORKS and ADVISE on their EXTENSION or ALTERATION, making SPECIFICATIONS, DRAWINGS, ESTIMATES, and superintend erection if desired.

SPECIALITIES.

Any EXTENSION or ALTERATION to GAS or WATER WORKS. ASSESSMENT of Gas-Works. New HOLDERS, TANKS, ROOFS. PURIFIERS, or FILTER-BEDS. TELESCOPING or adding FRESH LIFTS to EXISTING HOLDERS.
REGENERATIVE SETTINGS, for SMALL GAS-WORKS, without Excavations. SAVING 20 PER CENT. in first cost, renewals, and working.
Address "Bor," 9, Gracechurch Street, LONDON, E.C.

CLEVEDON GAS COMPANY.

TAR CONTRACT.

TENDERS are invited for the surplus TAR for One, Two, or Three Years, f.o.r. at Clevedon Station.

GAS EXHAUSTER.

TENDERS are invited for the supply of one GAS EXHAUSTER 6000 and 8000 cubic feet per hour.

Tenders to be sent in to me on or before the 21st day of February.

SAMUEL DAWES,
Manager.

TO RETORT MAKERS.

THE Gas Committee of the Todmorden Local Board are prepared to receive TENDERS for the supply and delivery of 44 Ω RETORTS.

Further Particulars may be obtained from the undersigned.

Sealed tenders, endorsed "Retorts," to be addressed to the Chairman of the Gas Committee, and delivered to me not later than the 19th inst.

GEORGE E. SAVILLE,
Engineer and Manager.

Gas-Works, Todmorden,
Feb. 2, 1894.

TO PIPE FOUNDERS.

THE Gas Committee of the Todmorden Local Board are prepared to receive TENDERS for the supply of 1860 yards or thereabouts of 18-inch CAST-IRON MAINS and requisite SPECIALS.

Particulars and Forms of Tender may be had on application to the undersigned.

Sealed tenders, endorsed "Mains," to be addressed to the Chairman of the Gas Committee, and delivered to me not later than the 19th inst.

GEORGE E. SAVILLE,
Engineer and Manager.

Gas-Works, Todmorden,
Feb. 2, 1894.

BOROUGH OF BARROW-IN-FURNESS.

THE Corporation are prepared to receive TENDERS for the supply of FIRE-CLAY RETORTS (Machine moulded only), FIRE-BRICKS and CLAY, CAST-IRON MAIN PIPES, WROUGHT-IRON TUBES and FITTINGS, BRASS COCKS, GAS-METERS, and SULPHURIC ACID, as may be required from the 1st day of April next to the 31st day of March, 1895.

Sealed tenders, on forms to be obtained at the Office of the Manager of the Gas and Water Works, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Stores," to be delivered at the Town Clerk's Office on or before Tuesday, the 20th inst.

The lowest or any tender not necessarily accepted.

By order,
C. F. PRESTON,
Town Clerk.

Town Hall, Barrow-in-Furness,
Feb. 9, 1894.

BOROUGH OF BARROW-IN-FURNESS.

THE Corporation are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Gas-Works from the 1st day of April next to the 31st day of March, 1895, delivered into Purchaser's Tank-Waggons at the Gas-Works Siding.

Any further Information may be obtained on application to the Manager of the Gas-Works.

Sealed tenders, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Tar," to be delivered at the Town Clerk's Office on or before Tuesday, the 20th inst.

The highest or any tender not necessarily accepted.

By order,
C. F. PRESTON,
Town Clerk.

Town Hall. Barrow-in-Furness,
Feb. 9, 1894.

BOROUGH OF DEWSBURY.

THE Gas Committee invite Tenders for the supply of RETORTS, FIRE-BRICKS, &c.

Particulars of Quantities and Forms of Tender may be obtained from Mr. Chas. A. Craven, Engineer and Manager, Savile Town Gas-Works, Dewsbury.

The Contractors will be required to give an assurance that they will pay to the efficient and capable workmen employed by them not less than the minimum standard rate of Wages in each branch of the Trade.

Sealed tenders, endorsed "Tender for Retorts," to be sent to me the undersigned not later than Saturday, the 17th inst.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
E. MAWDESLEY,
Town Clerk.

Town Clerk's Office, Town Hall, Dewsbury.
Feb. 9, 1894.

COUNTY BOROUGH OF BURNLEY.

TO GASHOLDER MAKERS.

THE Gas Committee of the Corporation of Burnley invite TENDERS for the TAKING OUT of an OLD GASHOLDER and the construction and erection of a NEW FIVE-LIFT GASHOLDER.

The Specification and Drawings may be seen, on and after the 9th of February, 1894, on application to the undersigned, from whom Bill of Quantities and Form of Tender may be obtained on deposit of One Guinea, which will be returned on receipt of a *bonâ fide* tender.

Tenders under seal, endorsed "Tender for Gasholder," to be addressed to the Chairman of the Gas Committee, and delivered at the Town Clerk's Office, Town Hall, Burnley, on or before Wednesday, the 28th of February, 1894.

JNO. P. LEATHER,
Gas Engineer.

Gas-Works, Burnley,
Jan. 31, 1894.

ROCHDALE CORPORATION.

TO ENGINEERS AND OTHERS.

THE Gas Committee of the above Corporation invite TENDERS for the supply and erection of COAL BREAKING, ELEVATING, and CONVEYING MACHINERY to Twenty Settings of Inclined Retorts.

Plans of the Building may be seen, and all necessary Information obtained, on application to Mr. T. Banbury Ball, the Manager, at the Gas-Works, to whom tenders, endorsed "Machinery" must be sent in not later than Noon on Wednesday, Feb. 28, 1894.

By order,
ZACH. MELLOR,
Town Clerk.

Town Hall, Rochdale.
Feb. 9, 1894.

BRADFORD CORPORATION WATER-WORKS.
NIDD VALLEY SUPPLY.
CONTRACT NO. 4.

TO STEEL PIPE MAKERS.

THE Bradford Corporation invite TENDERS for the supply of 1800 tons or thereabouts of MILD STEEL PIPES, 36 inches diameter.

Copy of Specification, Schedule of Quantities, and Drawings, may be obtained on application to Mr. James Watson, M.Inst.C.E., Water-Works Engineer, Town Hall, Bradford, upon payment of Two Guineas, which will be returned on receipt of a *bonâ fide* tender.

Sealed tenders, marked "Tender for Mild Steel Pipes," must be addressed to the Town Clerk, Town Hall, Bradford, and be delivered on or before the 1st of March next.

The Contractor must give an assurance to the Corporation that he pays to the workmen employed by him not less than the minimum standard rate of wages.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
W. T. M'GOWEN,
Town Clerk.

Town Hall, Bradford,
Feb. 9, 1894.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

TO THE PROPRIETORS.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Company's Offices, No. 5, Great Winchester Street, London, on Friday, the 2nd of March, 1894, at Two o'clock in the afternoon precisely, to receive the Report of the Directors and the Accounts of the Company for the Half Year ended the 31st of December, 1893, to declare Dividends, to elect Directors, to appoint a Special Auditor, and for other purposes.

The Transfer Books of the Company will be closed from the 17th of February to the 2nd of March, both days inclusive.

By order,
W. H. HARDY,
Secretary.

Offices: 5, Great Winchester Street,
London, E.C., Feb. 10, 1894.

MANCHESTER CORPORATION GAS-WORKS.

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee of the Corporation of Manchester are prepared to receive TENDERS for the purchase and removal of the GAS TAR to be produced at their several Stations during a period of One, Two, or Three Years, commencing as follows, viz.:—

Bradford Road Station, from noon on the 31st of March, 1894.
Rochdale Road Station, from noon on the 24th of June, 1894.
Gaythorn Station, from noon on the 1st of August, 1894.

The Committee do not bind themselves to accept the highest or any tender, and reserve the right to divide the tenders as they may consider advisable.

Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Tar," must be delivered at the Offices of the Gas Department, Town Hall, on or before Thursday, the 1st of March next.

Forms of Tender and other Particulars may be obtained on application in writing to Mr. Charles Nickson, Superintendent of the Department.

By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
Feb. 2, 1894.

BROMLEY GAS CONSUMERS' COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of this Company will be held at the Bell Hotel, Bromley, Kent, on Monday, the 26th day of February inst., at 5.45 p.m., precisely, to receive the Report of the Directors, the Balance-Sheet confirmed by the Auditors, to declare Dividends, and for General Business.

The Transfer Books will be closed from the 12th to the 26th of February, 1894, both days inclusive.

By order of the Board,
HENRY W. AMOS,
Secretary.

Offices at the Works, Bromley, Kent.
Feb. 10, 1894.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors in this Company will be held at the Company's Offices, Willoughby Lane, Tottenham, on Saturday, the 24th day of February inst., at half-past three o'clock in the afternoon precisely, to receive the Report of the Directors, the Statement of Accounts for the Half Year ended the 31st day of December, 1893, to declare a Dividend, and transact such other Business as the Act of Parliament directs.

The Transfer Books will be closed from Saturday, the 10th, until Monday, the 26th inst.

By order of the Board,
JAMES RANDALL,
Secretary.

Offices of the Company: Willoughby Lane,
Tottenham, Feb. 9, 1894.

MITCHAM AND WIMBLEDON DISTRICT GAS-LIGHT COMPANY.
(INCORPORATED BY ACT OF PARLIAMENT 1867.)

NOTICE is Hereby Given, that the FIFTY-FOURTH ORDINARY HALF-YEARLY GENERAL MEETING of the Shareholders of this Company will be held in the Board-Room, at the Works, Mitcham, in the County of Surrey, on Tuesday, the 27th day of February, 1894, at Three o'clock in the afternoon precisely, to receive the Report of the Directors and a Statement of the Accounts for the Half Year ended the 31st day of December last, to declare a Dividend, to elect Directors and an Auditor in place of those retiring by rotation, and for General Business.

The Transfer Books will be closed from the 12th inst. until after the meeting.

By order,
BENJAMIN GREEN,
Secretary and Manager.

Offices and Works: Western Road, Mitcham,
Feb. 10, 1894.

CRYSTAL PALACE DISTRICT GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Albion Tavern, Aldersgate Street, on Friday, the 23rd day of February, 1894, to receive the Report of the Directors, the Balance-Sheet, examined and signed by the Auditors, to elect two Directors and one Auditor retiring by rotation, and to declare a Dividend.

Notice is Hereby also Given, that, at such Meeting, the Directors will submit to the Proprietors, for their approval, a Resolution determining the Remuneration of the Secretary, in accordance with the provisions of the Companies Clauses Consolidation Act, 1845, and also a Resolution with reference to a retiring allowance to the late Secretary.

The Transfer Books will be Closed from the 9th day of February until after the Meeting.

The Chair will be taken at Three o'clock precisely.

By order of the Board,
CHARLES M. OHREN,
Secretary.

Feb. 9, 1894.

ELEVENTH YEAR. Now Ready (Demy 8vo., Price 5s. 6d, post free),

THE COMPLETE REPORTS OF THE PROCEEDINGS
OF THE VARIOUS
DISTRICT ASSOCIATIONS of GAS MANAGERS FOR 1893.

*** THE TEN PREVIOUS VOLUMES (for 1883 to 1892) ARE STILL ON SALE.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

Price 6s., Cloth Bound,

THE CHEMISTRY OF ILLUMINATING GAS,

By

NORTON H. HUMPHRYS, Assoc. M.Inst.C.E., F.C.S

This work contains chapters on: The Relative Cost of Light from Gas, Oil, and Candles; Products of Combustion; The Sulphur Question; The Composition of Illuminating Gas; Water Gas; Various Gas-Making Processes; Oil Gas; Properties of Fluid Hydrocarbons; Tar for Gas Making; Destructive Distillation; Condensation; and Purification.

LONDON:

WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

Price 15s., Limp Cloth, the Thirteenth Yearly

ANALYSIS OF THE ACCOUNTS

OF THE

Metropolitan Water Companies,

Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex—showing the Capital, Income, Expenditure, Profits, and Dividends per Million and per Thousand Gallons of Water supplied; the proportion of Expenditure and Profits to gross Income; and the Income, Expenditure, and Profits per House, &c., supplied for the year ended December 31, 1892, or March 31, 1893, together with the quantity of Water supplied, the estimated daily quantity supplied for domestic and other purposes, the quantity supplied per head of population, &c., &c., for the year ended December 31, 1892.

Compiled and arranged by

ALFRED LASS, F.C.A.

LONDON:

WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,

HOLMSIDE AND SOUTH MOOR OFFICES,

NEWCASTLE-ON-TYNE.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,

56, ROBERTSON STREET, GLASGOW.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.

B Lombard Street,

NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI, LONDON, W.C.

T.B.KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T.B.KITTEL, SHEFFIELD.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON,

FITTER.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.

Tudhoe Gas-Works,

Spennymoor,

8th June, 1893.

Messrs. The

WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.

Yield of Coke: 13½ cwt.

Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**

The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,

Yours truly,

A. B. COWAN,

Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
Shipments Promptly and Carefully Executed.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

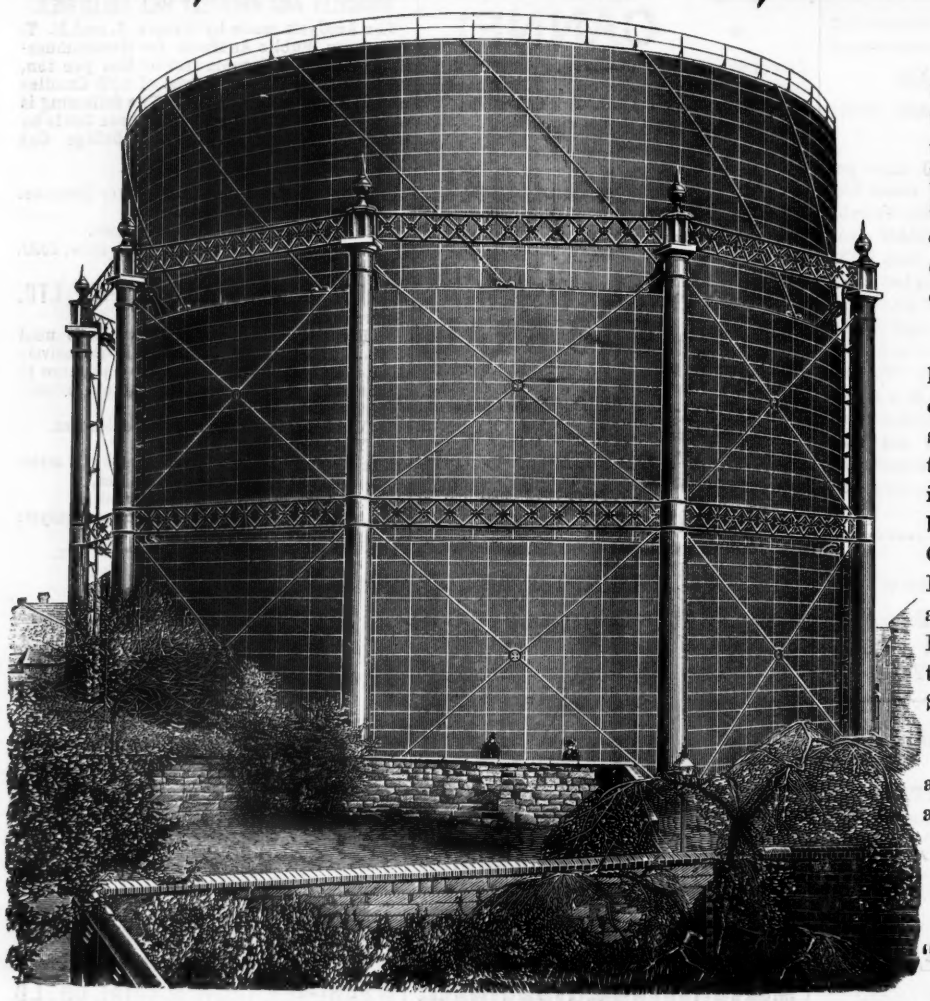
HUNTER'S
OXIDE OF IRON.
James Hunter, Lessee, Miner, and Shipper of NATURAL IRISH BOG ORE.
This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.
Samples and Prices on application.
11, BAY STREET, PORT GLASGOW.
Telegrams: "Hunter Port Glasgow."
Established 1872.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**
Address
JAMES WHITE & Co., Limited,
ALBERT WORKS, WIDNES.

COKE BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT.)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.
For Exhauster Advertisement, see last week.
GEORGE WALLER & CO.,
PARK STREET, SOUTHWARK, E.C.,
And at STROUD, GLOUCESTERSHIRE.

R. & J. DEMPSTER,
Limited,
GAS PLANT WORKS,
NEWTON HEATH, MANCHESTER.
SOLE LICENSEES OF
SPIRAL GUIDED GASHOLDERS.



This illustration is taken from a photograph, showing the addition of a Third Lift to an ordinary Telescopic Holder, 102 ft. diameter by 56 ft. deep, which has been in constant use for upwards of eighteen months, and given entire satisfaction.

The Spiral Guided Gasholders may be adapted to increasing the storeage of any style of Gasholders without interfering with existing Framing or Tank. They have been erected in Brick, Stone, Concrete, Cast and Wrought Iron Tanks, and undoubtedly are the steadiest under Wind Pressure, in addition to being the safest and strongest in Snow-Storms and Frost.

Estimates, Testimonials, and further Particulars on application.

Telegrams:
"SCRUBBER MANCHESTER."

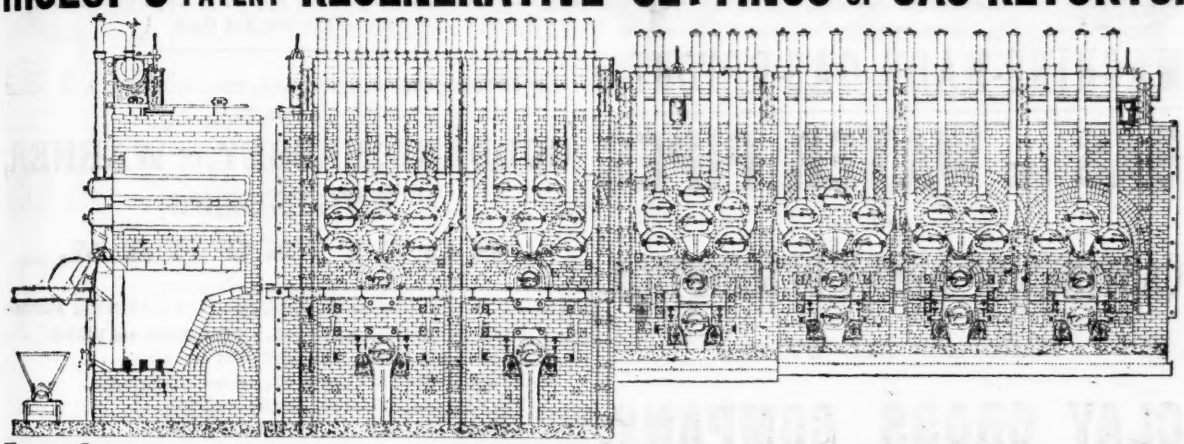
London Office: 181, Gresham House, Old Broad Street, London, E.C.

THE SILICA FIRE-BRICK COMPANY,
OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE
SILICA BLOCKS, BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.
Trade Mark: "SILICA."
These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY
Strongly recommended where EXCESSIVE HEATS have to be maintained.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.
FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS AND HAVE ALREADY BEEN VERY EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.
THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Chief Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S Patents, all Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

Descriptive Pamphlets and Terms from Agents as above.

"YEADON" REVOLVING GAS-RETORTS

(YEADON AND ADGIE'S PATENTS)

FULL PARTICULARS AND ESTIMATES GIVEN BY

THE YEADON GAS-RETORT SYNDICATE, LIMITED,
4, ALBION PLACE, LEEDS;
Or their Sole Representatives: D. M. NELSON & SONS, 68, Bath Street, GLASGOW.

ALEX. C. HUMPHREYS, M.E.,
General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

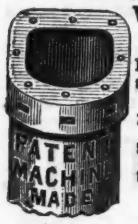
A. G. GLASGOW, M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
9, Victoria Street, London, S.W.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,
WORTLEY FIRE-CLAY WORKS,
Near LEEDS,



Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES
AND
CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,
CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
C X O	"JACKSON"	BECK & Co.,
MARK.	CLAY CROSS.	130, GT. SUFFOLK ST., S.E.

GODDARD, MASSEY, & WARNER'S
IMPROVED
Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICE APPLY TO

GODDARD, MASSEY, & WARNER,
ENGINEERS,
NOTTINGHAM.

The Apparatus has been supplied to the following Firms—
BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (Four Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD	ORMSKIRK.	LUTON.
		HAMPTON COURT.

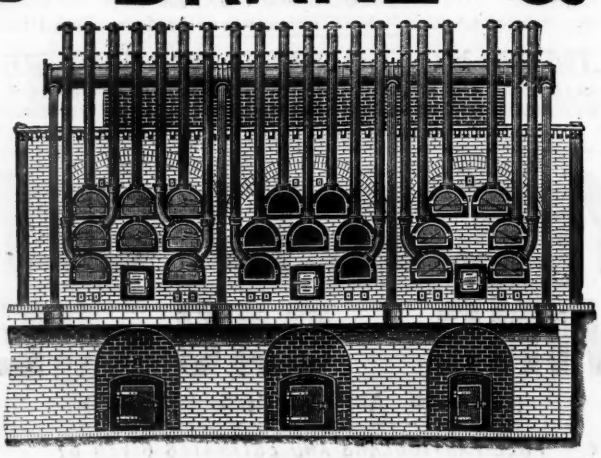
JONAS DRAKE & SON,

TELEGRAPHIC ADDRESSES:
"DRAKESON, HALIFAX."
"ECLAIRAGE, LONDON."

TELEPHONE No. 43.
HALIFAX EXCHANGE.

GAS ENGINEERS,
CONTRACTORS,
IRONFOUNDERS,

BUILDERS AND ERECTORS OF EVERY DESCRIPTION OF OVENS, BENCHES, KILNS, FURNACES, &c.



RETORT SETTERS,
FURNACE BUILDERS
ETC., ETC.

REGENERATOR AND GENERATOR FURNACES ON DRAKE'S, FRITH'S, SIEMENS'S, KLONNE'S, HASSE'S VALON'S, SOMERVILLE'S, PONSARD'S and other Principles.

INCLINED RETORTS

GASEOUS FIRING A SPECIALTY.

RETORT SETTING IN ALL ITS PRINCIPLES AND BRANCHES. BENCHES FITTED UP COMPLETE.
DRAWINGS, SPECIFICATIONS, AND ALL OTHER PARTICULARS ON APPLICATION.

LONDON OFFICE:
60, QUEEN VICTORIA ST., E.C.

OVENDEN, HALIFAX.

IRISH OXIDE OF IRON.

GAS PURIFICATION.

RIKY'S OXIDE (formerly worked by Messrs. Stanley and Olphert).

THE LARGEST SUPPLY OF OXIDE IN HAND OF ANY OTHER FIRM IN THE WORLD.

Purity and Uniformity of Quality Guaranteed.

RIKY AND Co. can supply the above at a much lower rate than any other firm in the trade, being owners of the property where it is found. *No Middleman* or *Agent* receives a profit.

SAMPLE AND PRICE ON APPLICATION.

Address JOHN RIKY AND CO., Killygordon, County Donegal; and 193, Great Brunswick St., Dublin. Telegrams: "RIKY, KILLYGORDON."

STEEL SCOOPS FOR RETORT CHARGING.

Scoops supplied with or without handles, and of any dimensions or shape required.

HENRY SYKES, Engineer,
66, BANKSIDE, LONDON, S.E.

Demy 8vo., Cloth, Price 3s. 6d., Post Free,

THE SCIENCE AND PRACTICE OF LIGHTING.

By W. H. Y. WEBBER.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of

ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 16-candle gas per ton.
Weight of illuminating power in pounds of sperm, 320·80. Very free from impurities.
Telegrams: "ATLAS SHEFFIELD."

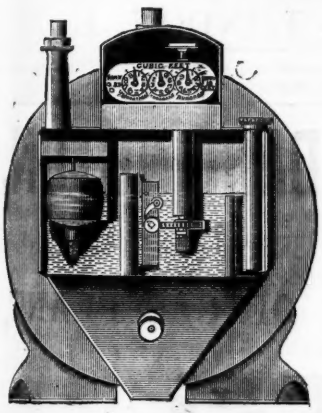
WILLEY & Co., EXETER.

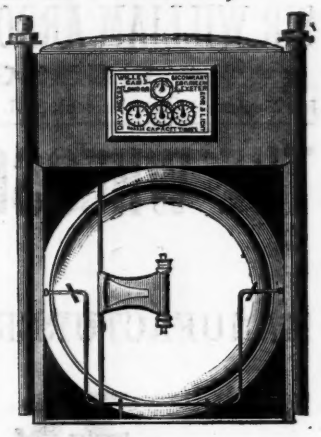
Telegraphic Address: "WILLEY, EXETER."

SPECIALITIES—

GAS-METERS, WET AND DRY,

SUPERIOR MAKE.





STATION METERS—TEST-METERS—GOVERNORS.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND DISTRICT OFFICE: 22, TEMPLE ST., BIRMINGHAM—SOLE AGENT: A. C. SCRIVENER.

TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE NO. 200.

LONDON DISTRICT OFFICE: 6, STRAND, LONDON—C. PARKER & SON, SOLE AGENTS.

TELEGRAPHIC ADDRESS: "PARKER LONDON."

TELEGRAPHIC ADDRESS: "ROBUSTNESS, LONDON." EXCHANGE TELEPHONE 1756.

GASEOUS FIRING FOR LARGE OR SMALL RETORT-SETTINGS

PLANS, SPECIFICATIONS, AND ESTIMATES SUBMITTED.

SPECIALTIES

J. & H. ROBUS,

20, BUCKLERSBURY, LONDON, E.C.

ENGINEERS & CONTRACTORS

FOR THE ERECTION OF GAS AND WATER WORKS COMPLETE, AND FOR EXTENSIONS AND RENEWALS.

CARLESS, CAPEL & LEONARD,

HOPE CHEMICAL WORKS, HACKNEY WICK, LONDON, N.E.,

NAPHTHA AND GASOLINE DISTILLERS AND PETROLEUM IMPORTERS,

Specially distil Carburine Spirit, specific gravity ·680, or of any other grade suitable for Enriching Gas; also Gas Oil best adapted for injecting into the Retorts as in the Herring Process.

Importers of Petroleum for Carburetting Water Gas, or for Manufacturing Oil Gas. Distillers of Petroleum Ether and Naphtha for clearing the Pipes of Naphthalene, &c.

Samples and Prices may be had on application.

Price One Guinea.

PRECEDENTS IN PRIVATE BILL LEGISLATION AFFECTING GAS & WATER UNDERTAKINGS.

1879-1890.

By E. H. STEVENSON and E. K. BURSTAL, MM.Inst.C.E.

The Work published in 1879 by the late Mr. Stevenson is still on sale.

LONDON: WALTER KING, 11, BOLT COURT, FLEET ST., E.C.

ARROL-FOULIS

Patent Automatic Machinery

FOR

DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,

SIR WILLIAM ARROL & CO., Limited,

GLASGOW.

See Illustrated Advertisement, p. II. Centre of JOURNAL for Feb. 6.

STOURBRIDGE RETORTS AND FIRE-BRICKS.

BEST QUALITY.

KING BROTHERS, STOURBRIDGE.

[See Illustrated Advertisement, Feb. 6, p. 261.]

CROWTHER BROTHERS,

Contractors for the Erection of Gas-Works Complete, RETORT-SETTINGS, Furnace Building, and the Erection of Retort-Benches, &c., &c.

N.B.—Special attention given to the Erection of Inclined Retort-Benches on the Generator and Regenerative Principles complete.

MAIN LAYING IN ALL ITS BRANCHES.

For Terms and Particulars, apply to

CROWTHER BROTHERS,

152, Teviot Street, St. Leonard's Road,

POPLAR, LONDON, E.

Experienced Retort Setters and Main Layers sent to all Parts on the Shortest Notice.

THE WHESSOE FOUNDRY CO., LTD., DARLINGTON.

Established 1790.

MANUFACTURERS OF EVERY DESCRIPTION OF GAS PLANT,

FROM

RETORTS

TO

GASHOLDERS,

FOR WHICH THEY HAVE THE NEWEST AND MOST MODERN MACHINERY.

GASHOLDERS CAN BE MADE OF ANY DIAMETER AND PUT TOGETHER AT THE WORKS.

Holders having a capacity of 6,000,000 Cubic Feet have been made and erected; the largest one being 181 feet diameter by 136 feet 9 inches deep. Riveted entirely with $\frac{3}{8}$-inch diameter Hot Rivets.

SOLE MAKERS OF

THE WHESSOE PATENT CENTRE-VALVE

FOR WORKING PURIFIERS.

This Centre-Valve is the cheapest and most effective Valve in the market. Any unskilled workman can understand it; and it costs about half the price of any other Valve. The Purifiers can be worked in rotation or bye-passed singly, or bye-passed altogether; and the Valve can be worked either as a Hydraulic or Dry-Faced Valve.

AND SOLE MAKERS OF

COATES' IMPROVED PATENT FURNACE DOOR PROTECTOR

Which has been approved and adopted by the Gas Authorities at

SALFORD, MANCHESTER, BIRKENHEAD, STOCKTON, NEWCASTLE, DARLINGTON, &c.

Telegraphic Addresses: WHESSOE, DARLINGTON. WHESSOE LONDON. | T. COATES, MANAGING DIRECTOR. | WORKS: DARLINGTON. LONDON OFFICE: 28, QUEEN STREET, E.C.

SEND FOR PRICE LISTS

OF

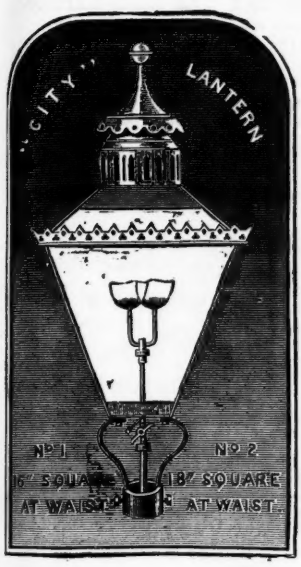
BRAY'S

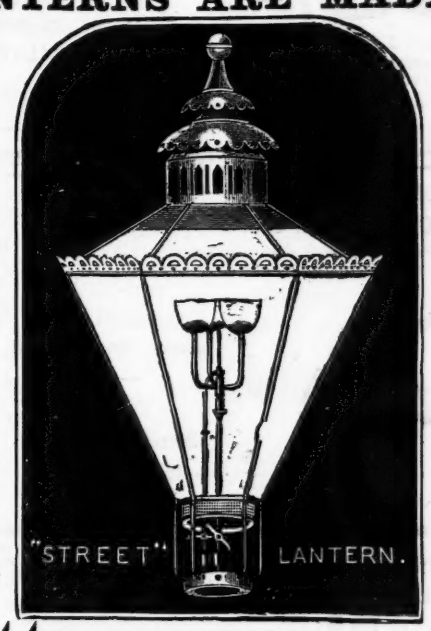
PATENT FLAT-FLAME LANTERNS.

From 30 to 1100 Candle Power.

They are suitable for Gas of every Candle Power.

ALL OUR LANTERNS ARE MADE OF COPPER.



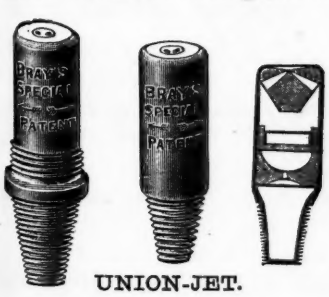


BRAY'S "SPECIAL" BURNERS

Are the best in the Market for general use, and are very moderate in price.

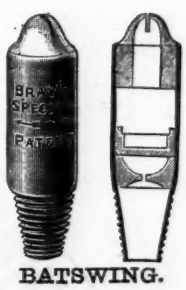
It is not unusual to see the ordinary Burner yielding less than half the light that Bray's "SPECIAL" would yield with the same consumption of Gas.

Gas Managers should try them on consumers' fittings; and they would see at once how to compete more effectively with the Electric Light.



UNION-JET.

SLIT-UNION.



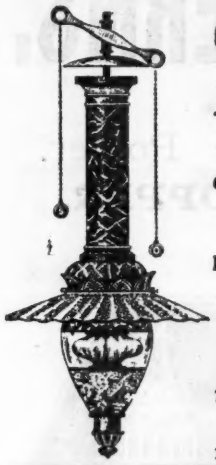
BATSWING.

GEO. BRAY & CO., GAS LIGHTING ENGINEERS, LEEDS.

HARPER & MOORES,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.
Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.
MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.
ESTABLISHED 1836.

The Climax of Regenerative Gas Lighting!!



THE
"VERTMARCHE"
A 280-CANDLE POWER
PLAIN IRON LAMP,
CLASS A— 55/-
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
Manufactured in England by
HENRY GREENE & SONS,
153 & 155, CANNON STREET,
LONDON BRIDGE, E.C.
PARTICULARS AND PRICES FREE. AGENTS WANTED.

TELEGRAPHIC ADDRESS "GAS LIDS." — LONDON OFFICES 60, QUEEN VICTORIA STREET, E.C.
CLAYTON, SON, & Co.
LIMITED,
LEEDS,
MAKE
RETORT LIDS
OF ALL FORMS AND SHAPES
IN IRON OR STEEL
BY SPECIAL HYDRAULIC MACHINERY.
PRICES ON APPLICATION.

JOSEPH CLIFF & SONS,
INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.,
WORTLEY, LEEDS.

LONDON Offices & Depôts:
Baltic Wharf, Waterloo Bridge.
WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.
LIVERPOOL:
16, Lightbody Street.
LEEDS:
Queen Street.

MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.
RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

WILSON CARTER & PEARSON,
GAS COAL AND CANNEL FACTORS,
Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.
ADDRESS CHIEF OFFICES:
Temple Buildings, 50, New Street, Birmingham.

THE THAMES BANK IRON CO.
UPPER GROUND STREET, LONDON, S.E.,
SUPPLY FROM STOCK
CAST-IRON RETORTS
AND ALL KINDS OF GAS-WORKS APPARATUS.
SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.
Sole Manufacturers of LYON'S 'PATENT' GAS MAIN SYPHONS.
AGENTS FOR
ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

THE DEIMEL GAS-LAMP.

Absolutely the Cheapest, Simplest, and most Economical Lamp before the Public.

Suitable for Suspension, or can be fixed to the ordinary Bracket in place of Burner.

Price of **Bracket Lamp, from 13s.**

Price of **Suspension Lamp, from 21s.**

Consumption 6 and 9½ cubic feet respectively.

Proprietors: THE DEIMEL LIGHT COMPANY, LIMITED,
86, GRAY'S INN ROAD, W.C. **Works: PORTPOOL LANE.**
LIBERAL DISCOUNT TO GAS COMPANIES.

J. & W. HORTON
ETNA WORKS,
SMETHWICK,
NEAR BIRMINGHAM
(Established 150 Years),
PATENTEES
AND
MANUFACTURERS
OF

IMPROVED GASHOLDERS AND BOILERS

and Manufacturers of every description of
Gas Apparatus,

Cast and Wrought Iron Tanks, Purifiers, Condensers, Scrubbers, Retort-Lids, Cross-Bars and Screws, Wrought-Iron Boilers for Stationary, Portable, and Marine Engines, Sugar Pans, Coolers, Clarifiers, Punts, Boats, Bridges, Girders, Roofs, Cisterns, Oil-Tanks, Melting-Pots, Crucibles, Salt-Pans, Arch and Range Boilers, and every description of General Ironwork.

Drawings, Specifications, and Estimates supplied.

HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE
MAINTAINS A HIGH STANDARD IN RESIDUALS.

THE GRASSMOOR Co., Ld., CHESTERFIELD.

CLAYTON SON & Co. LTD

MAKERS OF

WORKS LEEDS

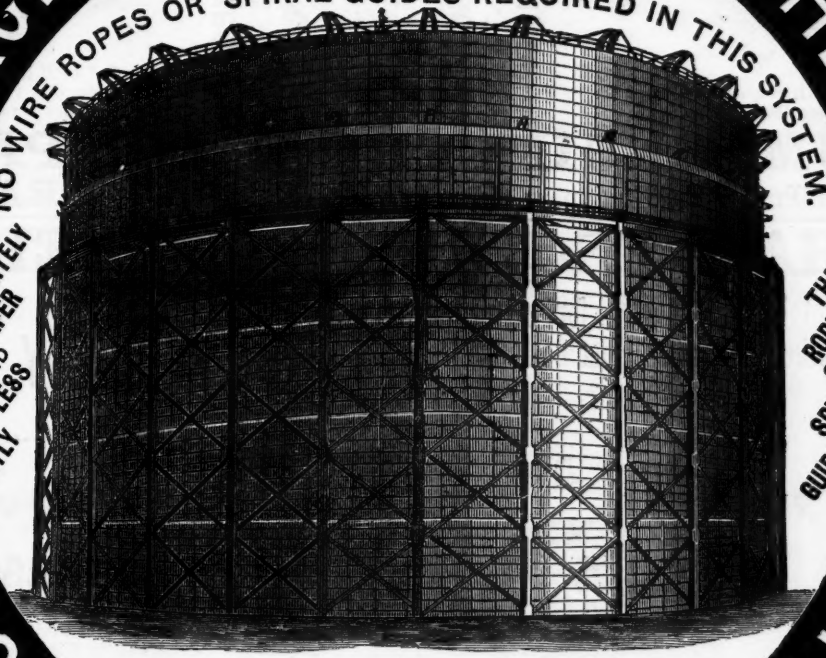
THE LARGEST GASHOLDER IN THE WORLD.

CAPACITY 12 MILLION CUBIC FT.

GASHOLDERS OUR SPECIALITY

NO WIRE ROPES OR SPIRAL GUIDES REQUIRED IN THIS SYSTEM.

INFINITELY SAFER AND FAR LESS COSTLY THAN ROPES OR SPIRAL GUIDES.



ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT. DEEP EACH AND IS 300 FT. DIAR.

MAKERS OF GAS PLANT OF EVERY DESCRIPTION
ROOFS PURIFIERS &c. ALSO

ADDRESS LONDON 60, QUEEN VICTORIA ST.
TELEGRAPHIC "GAS, LEEDS."
GASHOLDERS OF ANY SIZE

ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

ESTABLISHED 1825.

GAS TUBES

MANUFACTURERS OF EVERY DESCRIPTION OF

IRON OR STEEL LAP-WELDED OR BUTT-WELDED TUBES

FOR ANY PURPOSE.

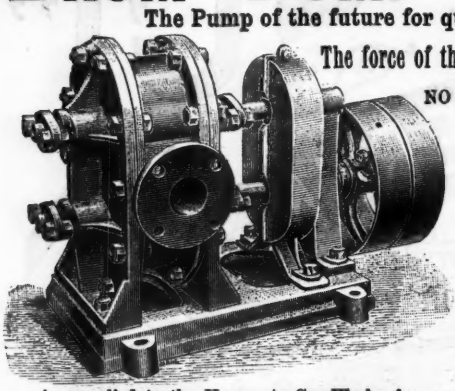
JOHNSON'S PATENT

DRUM PUMP AND GAS EXHAUSTER.

The Pump of the future for quickly and economically moving large bodies of Water.

The force of the Piston Pump with the capacity of the Centrifugal combined.

NO SLIDES OR FRICTIONAL WORKING PARTS.



As supplied to the Harrogate Gas-Works for Pumping Gas Liquor.

NO PRIMING.

NO VALVES.

As supplied to H.R.H. the Prince of Wales for Pumping Gas Liquor at his Sandringham Gas-Works.

DRUM ENGINEERING COMPANY,

Hydraulic and Pneumatic Engineers, 55, ATHOL ROAD, BRADFORD.

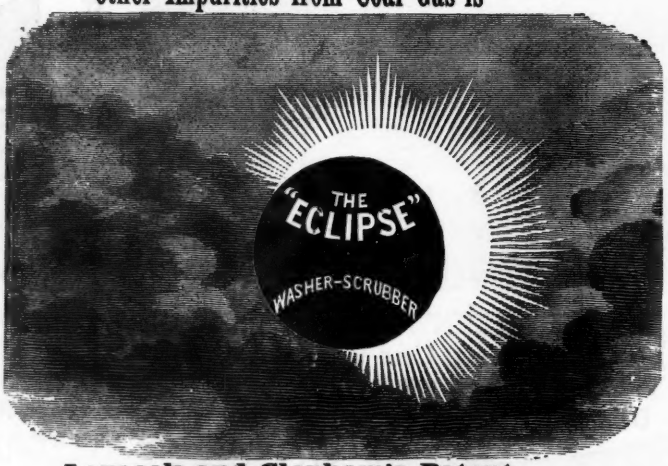
CLAPHAM BROTHERS, LIMITED,

ESTABLISHED 1837.

The most efficient Machine known for extracting Ammonia and other Impurities from Coal Gas is

KEIGHLEY, YORKS.

WELLINGTON, NELSON, & MARKET ST. WORKS.
Telephone No. 223.
Telegraphic Address: "CLAPHAM BROTHERS Keighley."



Laycock and Clapham's Patent.

The Patent Wooden Balls thoroughly break up the Gas; give an immense amount of freshly-wetted Surface; and do not clog or increase back pressure.

Whilst the Gas is passing through and amongst the Balls, it is continually showered upon by the contents of Buckets.

The Shaft Revolves in Improved Bearings, and all Workings are accessible.

REPAIRS AND TROUBLE REDUCED TO A MINIMUM.

MAKERS OF

PURIFIERS,

With Lutes Cast and Planed Joints,

CONDENSERS,

VALVES,

MAINS,

RETORT-FITTINGS.

LONDON: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd. 12, Gough Square;) and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Feb. 13, 1894.